Review Article

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AN AYURVEDIC INSIGHT TOWARDS EPILEPSY

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ABSTRACT
In Ayurveda, Mental disorders and psychological temperaments have been broadly described [e.g. vata vyadhi (nervous disorders), unmada (insanity), murccha, moha (loss of consciousness), vismriti (amnesia), apasmara (epilepsy) etc.]. In Ayurveda, Apasmara (or epilepsy) has been described among the maharoga (a group of eight diseases well-known for causing serious morbidity). In the Ayurvedic texts, Apasmara (Epilepsy) is defined as sudden abhorrent bodily activities (vibhatsa-cheshta) accompanied by momentary blackouts or loss of consciousness (tama-pravesha) owing to disturbance in mental faculties of dhi (intelligence), dhriti (retention) and smriti (memory). Epilepsy is a major public health problem all over world. The estimated proportion of the general population with active epilepsy (i.e. continuing seizures or the need for treatment) at a given time ranges from 4-10 per 1,000 people. Herbal remedies have been recommended in various medical treatises for the cure of different diseases. In this regard, there is great prospective for identifying excellent Ayurvedic components or its active principles, particularly in consideration of the fact that such substances may provide maximum advantage with cost effectiveness, least side effects, and improvement of patient compliance.
Keywords: Apasmara, Epilepsy, Maharoga, Herbal remedies.

INTRODUCTION

In Ayurveda, Mental disorders and psychological temperaments have been broadly described (e.g. vata vyadhi (nervous disorders), unmada (insanity), murccha, moha (loss of consciousness), vismriti (amnesia), apasmara (epilepsy) etc.). In Ayurveda, Apasmaara (or epilepsy) has been described among the maharoga (a group of eight diseases well-known for causing serious morbidity) which can only be controlled to some extent with medical therapies and yet still sometimes remain uncured and even uninhibited. In the Ayurvedic texts, Apasmara (Epilepsy) is defined as sudden abhorrent bodily activities (vibhatsa-cheshta) accompanied by momentary blackouts or loss of consciousness (tama-pravesha) owing to disturbance in mental faculties of dhi (intelligence), dhriti (retention) and smriti (memory).[1] Vagbhata defines it as loss (apaaya) of memory (smriti).[2] There are plentiful references to all aspects of epilepsy accompanied by prodromal symptoms (poorvaroopa), clinical features (rupa), pathogenesis (samprapti), diagnosis, and treatment (chikitsha) in the Ayurvedic literature.

Epilepsy is a major public health problem all over world. The estimated proportion of the general population with active epilepsy (i.e. continuing seizures or the need for treatment) at a given time ranges from 4-10 per 1,000 people. Epilepsy has significant economic implications in terms of premature death, health care-needs, and lost work productivity. WHO has recognized epilepsy to be a major public health problem. WHO, the International League Against Epilepsy (ILAE) and the International Bureau for Epilepsy (IBE) are carrying out a global campaign to provide better information and raise awareness about epilepsy, and strengthen public and private efforts to improve care and reduce the disorder's impact.

Definition

The word “epilepsy” comes from the Greek and means to be taken, seized or attacked. Epilepsy is a common and diverse set of chronic neurological disorders characterized by seizures. Seizures are episodes of disturbed brain activity that cause changes in attention or behaviour. Epilepsy is a chronic neurological disorder that affects people of all ages. Epilepsy is characterized by “recurrent, episodic, paroxysmal, involuntary clinical events associated with abnormal electrical activity from the neurons”[3]. It is a life-long tendency, though the seizures may start at any time during life and occur at irregular intervals or frequently.

Prodromal symptoms, Classification and Etiology

Acharya Sushruta describes various causes of Apsmara e.g. excessive, inadequate and improper consideration to the objects of the sense as well as to their actions, part taking of filthy, contaminated, unwholesome and unhygienic uncongenial foods and regimen of conduct, repression of any natural urging of the body or aggravation of the rajas and tamas (manas guna), or psychological factors (likewise indulgence in amorous fancies, fright, anxiety, anger, or grief, etc.), leads to an aggravation of the bodily doshas (humors) which in their turn affect the mind (chetas) ultimately and leading to the manifestation of the epileptic fit in the form of shaking body movements, jerks or convulsions (akshepaka) or episodes of brief unconsciousness and at last give rise to Apasmara.[4]

There are different causes of epilepsy that are common in certain age groups. These are: 1) During neonatal period and early infancy causes include hypoxic ischemic

encephalopathy, CNS infections, trauma, congenital CNS abnormalities, and metabolic disorders. 2) During late infancy and early childhood: febrile seizures, CNS infection and trauma etc. 3) During childhood, well-defined epilepsy syndromes. 4) During adolescence and adulthood, idiopathic epilepsy, trauma, CNS infections, brain tumors, illegitimate drug use and alcohol withdrawal. 5) In older adults, cerebrovascular diseases is a very common cause and other causes are CNS tumors, head trauma, and other degenerative diseases that are common in the older age group, such as dementia.

Premonitory symptoms of Apasmara as in Ayurveda are sensations of pounding of the heart, emptiness or lightness in the head, perspiration, pensiveness, fainting, stupefied appearance and sleeplessness, which are usually found to usher in an attack.[4] Symptoms of apasmara in Ayurveda are described in the respective doshaj type as Vataja, Pittaja, Kaphaja and Sannipataja types. In vataj apasmara: shivering, clenching of the teeth, laboured breathing and foaming at the mouth present. Similarly thirst, increased heat of the body, perspiration, fainting, mild tremor of the limbs and restlessness in pittaj and shivering, nausea, sleepiness, falling on the ground and vomiting of mucus in kaphaj, and mixed features in sannipataj apasmara[1,4]. Clinical features include seizures, loss of awareness or consciousness, disturbances of movement, hallucinations (including vision, hearing and taste), mood or mental function. People with seizures tend to have more physical problems (such as fractures and bruising), higher rates of other diseases or psychosocial issues. Acharya Charaka[1] also mentioned that aggravated vatadi dosha produces apasmara episodes in the interval of every fifteen days or in monthly time period. For clinical description, epilepsy broadly described as generalized or partial (focal). ILAE classified epilepsy as generalized, localized and undetermined syndromes which have their sub types and characteristics clinical features.[3]

Clinical examination, Diagnosis and Treatment

In Ayurveda, Rogi-pariksha (an inclusive evaluation of the patient) and roga-pariksha (Poorvarupa, Rupa, and Samprapti) are to precede the disease diagnosis. In other words, a detailed history of the patient for a correct diagnosis is emphasizes in Ayurveda. For the management of apasmara, the Panchkarma therapy, (i.e. Vaman, Virechan, Vasti and Nasyadi), has been advised which utilises a number of formulations as : 1) Ghritas (clarified butters) - Panchgavya ghrita, Brahmi ghrita, Vachadi ghrita, Goghrita etc. 2) Medicated oil- Katbhayadi oil, Palankshadi oil, Triphaladi oil etc. 3) Dhupana dravyas and nasya yoga[1] 4) Rasaushadhi- Bhutbhairava rasa, Vatakulantka rasa, Sutbhasma etc[5]. Acharya Sushruta also recommended Siravedha (blood-letting) from the veins of the temples in epilepsy.[4] Epilepsy requires management under supervision of a physician for prolonged period which may extends from one to four decades. Age, sex, economic factors and seizure type determine choice of anti epileptic drugs. Commonly used anti epileptic drugs are Phenobarbitone, Phenytoin, Sodium Valporate, Carbamazepine, Cloazepam, Diazepam, and ACTH etc.

The ideal anti-seizure drug is supposed to suppress all seizures without causing any untoward effect. Unluckily these drugs also frequently cause side effects. In addition to adverse effects, other important parameter like safety, tolerability, efficiency, expenses especially in long term therapy, serum drug monitoring etc. are other limitations with synthetic antiepileptic drugs. For example, Phenobarbitone has adverse effects like behavioural abnormalities, diminution of intelligence, impairment of learning and memory, rashes, megaloblastic anemia and osteomalacia etc. occur in some patients on prolonged use.[3] Similarly other anti epileptic drugs also has adverse effects in prolonged use.

Herbal remedies have been recommended in various medical treatises for the cure of different diseases. Phytomedicine consists of many organic chemical constituents with complex pharmacological effects on the body. Considering the burden of epilepsy management, there has been a continuous effort to develop drugs that will postponement the development and arrest the progress of the disease. In this regard, there is great prospective for identifying excellent Ayurvedic components or its active principles, particularly in consideration of the fact that such substances may provide maximum advantage with cost effectiveness, least side effects, and improvement of patient compliance. So, Ancient medicine systems should be combined to plan effective health-care delivery systems for better epilepsy care. There is following ayurvedic formulation which showed the antiepileptic effects as:

Acorus calamus*:* The roots and rhizomes of *Acorus calamus* have been used in the ancient systems of medicine for the treatment of various neurological disorders. The effects of aqueous extract of *Acorus calamus* was evaluated on electrical and chemical induced seizures in albino mice and results indicates that aqueous extract has protective effect against maximal electrical shock (MES), but not against pentylenetetrazole (PTZ) induced seizures.[6] V. Pandy *et al.*[7] research provided evidences that methanol and acetone extracts of *Acorus calamus* may contain psychoactive substances that are CNS depressant in nature while used in mice. R hazara *et al*.[8] study also showed that *Acorus calamus* possesses the ability for preventing the development of $FeCl_3$-induced rat epileptogenesis by modulating antioxidant enzymes.

Albizzia lebbeck: The ethanolic extracts of leaves of *A. lebbeck* and flowers of *Hibiscus rosa sinesis* and the petroleum ether extract of flowers of *Butea monosperma* was evaluated for anticonvulsant activity in mice and findings showed that these fractions protected the animals from maximum electro shock, electrical kindling and pentylenetetrazole-induced convulsions.[9] In other study, saponins of *A. lebbeck* leaves showed nootropic and anxiolytic activity.[10]

***Anacyclus pyrethrum*:** Hydroalcoholic extract of *A. pyrethrum* administration significantly prevented seizure induced oxidative stress and cognitive impairment in a dose-dependent manner as well as normalized the decrease in cholinesterase activity caused by seizures when evaluated in male wistar rats.[11]

Anisomeles malabarica: The ethyl acetate extract of *A. malabarica* leaves evaluated for the anti-epileptic

potential against PTZ- and MES model in wistar rats and study concluded that the flavonoids fraction of the extract of *Anisomeles malabarica* leaves has antiepileptic potential.[12]

***Anthocephalus cadamba*:** The ethanolic extract of *A. cadamba* bark was used in various experimental animal models for sedative and antiepileptic activities and investigatory results proved sedative and antiepileptic activities.[13]

Argyreia speciosa: Different doses of *A. speciosa* extract were used in the mice for 10 days and then, mice were subjected to either pentylenetetrazole (80 mg/kg) or maximal electroshock seizures treatment and study revealed anticonvulsant effect of *Argyreia speciosa* against pentylenetetrazole - and maximal electroshock-induced convulsions in mice.[14] In other study, the hydroalcoholic extract of *Argyreia speciosa* root showed significant antistress activity in the trail animals.[15]

Asparagus racemosus: The extracts of *A. racemosus* was investigated by studying the effects on seizures induced by maximal electroshock (MES) and pentylenetetrazole in rats for the anticonvulsant activity and results showed significant anticonvulsant effect by decreasing the duration of hind limb extension (extensor phase), clonus and also the duration of stupor phase as compared to control in MES test. Methanol extract and aqueous extract of *A. racemosus* significantly prolonged the onset of tonic seizures which was induced by pentylenetetrazole.[16]

Bacopa monnieri: *Bacopa monnieri* is a nervine tonic used for raising the mental performance in Ayurveda therapy. It helps in concentration, comprehension, recall and alertness. Reas Khan *et al* [17] indicates the neuroprotective role of *B. monnieri* extract in glutamate-mediated excitotoxicity during seizures and cognitive damage occurring in association with pilocarpine-induced epilepsy. Jobin Mathew *et al* [18] studied the effects of *Bacopa monnieri* and its active component, bacoside A, on motor deficit and alterations of GABA receptor functional regulation in the cerebellum of epileptic rats were investigated and results showed prevention of the occurrence of seizures thereby reducing the impairment of GABAergic activity, motor learning, and memory deficit.

Benincasa hispida: *Benincasa hispida* ethanol extract at the dose levels of 250 and 500 mg/kg p.o. produced significant ($P<0.01$) anticonvulsant effect when used in swiss albino mice. [19]

***Berberis vulgaris*:** Berberine (an isoquinoline alkaloid from *Berberis vulgaris*) exhibits anticonvulsant activity by modulating neurotransmitter systems during trail in pentylenetetrazole, maximal electroshock (MES) and kainic acid (KA)-induced convulsions in mice.[20] The another study concluded that berberine at high doses could be a useful protective agent in PTZ induced epileptic seizures in rats.[21]

Boerhaavia diffusa: Anticonvulsant activity of methanolic extract, liriodendrin-rich fraction, chloroform fraction and phenolic compound fraction were studied in pentylenetetrazol (PTZ)-induced seizures. The crude methanolic extract and liriodendrin-rich fraction showed a dose-dependent protection against PTZ-induced convulsions.[22]

Bramhi formulations: The effect of Bramhi Ghrita (a polyherbal formulation containing *Bacopa monneri, Evolvulus alsinoids, Acorus calamus, Saussurea lappa* and cow's ghee) on motor coordination, behavior, sleep, convulsions, locomotion and analgesia was evaluated in mice using standard procedures and results showed that Bramhi Ghrita protected mice from maximum electroshock and pentylenetetrazole-induced convulsions.[23] Brahmi Rasayan (an Ayurvedic preparation) was studied in mice and rats for its effects on the central nervous system at oral doses and trail suggests an involvement of the GABA-ergic system in the mediation of the central nervous system effects of Brahmi Rasayan.[24]

Butea monosperma: During trail, the anticonvulsive principle of *B. monosperma* was found to be a triterpene (TBM) present in the *n*-hexane: ethyl acetate fraction of the petroleum ether extract. TBM exhibited anticonvulsant activity against seizures induced by maximum electroshock (MES). TBM also inhibited seizures induced by pentylenetetrazol (PTZ), electrical kindling, and the combination of lithium sulfate and pilocarpine nitrate.[25]

Caesalpinia sp.: NI Baek *et al* [26] showed that the extracts from the wood of *Caesalpinia sappan* were fractionated using various steps and got compounds which showed remarkable anticonvulsant activity. Similarly in study done by Dinesh Kumar *et al* [27] ethanol extract of *Caesalpinia pulcherrima* leaves was investigated for anticonvulsant effect against maximal electroshock (MES) and pentylenetetrazole (PTZ) induced seizures in rats and mice at dose levels 200 and 400 mg/kg, *i.p.* respectively. The results of the study suggest that ethanol extract of *Caesalpinia pulcherrima* leaves possess anticonvulsant effect.

***Calotropis gigantea*:** Alcoholic extract of peeled roots of *Calotropis gigantea* was tested in albino rats for CNS activity. These results show the analgesic, anticonvulsant, anxiolytic and sedative effect of the extract.[28] In second study, evaluation of different extracts of stem barks of *Calotropis gigantean* for the anti-convulsant effect done by using MES and PTZ induced seizure models and findings concluded the potential anticonvulsant activity.[29]

Cannabis sativa: The natural *Cannabis sativa* compounds decreased the susceptibility of rat dorsal hippocampus to seizure discharges caused by afferent stimulation (cannabidiol supposed through effectively block the release of K^+ from the hippocampus caused by afferent stimulation) which showed its anticonvulsant activity.[30] Another work suggests that the anticonvulsant action of *Cannabis indica* resin in the rat is serotonin- and not catecholamine-mediated.[31] Similarly other studies showed anticonvulsant activity of *Cannabis sativa* compounds[32,33].

Capparis sp.: An alcoholic extract of aerial parts of *C. Deciduas* (including flowers and fruits) was screened for central nervous system activity using conventional behavioral animal models. In the pentylenetetrazole-induced seizures test, the *C. decidua* extract dose-dependently decreased ($P < 0.05$) the number of animals with convulsions and increased convulsion latency ($P < 0.001$) and the extract also decreased the duration of

tonic hind leg extension in maximal electroshock-induced seizures ($P < 0.001$) when compared with control. So, these findings of animal study suggested that *C. decidua* has CNS depressant and anticonvulsant activities.[34] *Capparis zeylanica's* ethanolic extract was subjected to acute toxicity and then screened for anticonvulsant activity on maximal Electroshock (MES) and pentylenetetrazole (PTZ) induced seizures models in albino wistar rats and findings indicate that extract consists of anticonvulsant effect. [35]

Cedrus deodara: Alcoholic extract of heart wood of *Cedrus deodara* were tested for its anxiolytic and anticonvulsant activity. Pentylene tetrazole (PTZ) and Maximal electro shock (MES) induced convulsions models in mice were used for the assessment of its anticonvulsant activity and findings showed the anxiolytic and anticonvulsant activity.[36]

Celastrus paniculatus: The effect of *Celastrus paniculatus* seed aqueous extract on learning and memory was studied in rats and mice and the study reveals that the aqueous extract of *Celastrus paniculatus* seed has dose-dependent cholinergic activity, thereby improving memory performance.[37]

***Centella asiatica*:** G. Visweswari *et al* [38] suggests the anticonvulsant activity of different extracts of *C. asiatica* extracts was due to its perceptible changes in the cholinergic system. Visweswari G. *et al* [39] trail similarly showed the anticonvulsant and neuroprotective activity of *Centella asiatica*. Y.K. Gupta *et al* [40] evaluated the effect of aqueous extract of *Centella asiatica* on the course of kindling development, kindling-induced learning deficit and oxidative stress markers in pentylenetetrazole (PTZ) kindled rats and showed potential as adjuvant to antiepileptic drugs as well as preventing the cognitive impairment.

Cissus quadrangularis: The aqueous extract of the stem of *C. quadrangularis* when used in trailed mice results in protection of mice against maximal electroshock, pentylenetetrazol, strychnine and n-methyl-d-aspartate-induced seizures or turning behavior and delayed the onset time of seizures induced by isonicotinic hydrazid acid. The results concluded that the extract of *C. quadrangularis* possesses anticonvulsant and sedative properties in mice.[41]

Clerodendrum infortunatum*:* Saponin (SN1) isolated from *C. infortunatum* leaves showed the anticonvulsant activity when tested in leptazol-induced seizures.[42] Similarly anticonvulsant activity of methanolic extract of *Clerodendron infortunatum* was noticed in albino mice and extract significantly delayed ($p < 0.01$) the onset and antagonized PTZ-and STR-induced seizures.[43]

Convolvulus pluricaulis: The methanolic extract of whole plant of *C. pluricaulis* was evaluated for antioxidant activity (by using DPPH free radical scavenging model) and anticonvulsant activity (by using maximal electroshock seizure model). Experimental results have shown that the extract reduced the mean recovery time from convulsion.[44] During other trail, *C. pluricaulis* (aqueous extract) possesses neuroprotective potential used in aluminium chloride induced neurotoxicity in rat cerebral cortex.[45]

Curcuma longa: The anticonvulsant activity of bisabolene sesquiterpenoids of *C. longa* in zebrafish and mouse seizure models were noticed during this study.[46] In another trail, Jithendra Chimakurthy *et al* [47] showed the significant effect of curcumin on the maximal electro shock induced Generalized tonic clonic seizures when studied against sub therapeutic doses of phenytoin and sodium valproate as well as has effect on memory retention in seizure induced rats.

Cyperus rotundus: Porwal Mayur *et al* [48] suggested that *Cyperus rotundus* roots and rhizomes showed anticonvulsant effect against PTZ and PTX induced convulsions which may be mediated, at least partly, through GABA A-benzodiazepine receptor complex. Shivkumar SI *et al* [49] found the flavonoids present in ethanol extract could be attributed for anticonvulsant activity. Mohsen Khalili *et al* [50] also concluded that *C. rotundus* rhizome extract, probably via its antioxidant properties could have exerted a potent antiepileptic effect.

Delphinium denudatum: The ethanolic extract and aqueous fraction of this plant screened for anticonvulsant utilising the maximal electroshock and subcutaneous pentylenetetrazole, bicuculline, picrotoxin and strychnine tests for anticonvulsant activity. The results suggest the presence of potent anticonvulsant compounds in AF of *D. denudatum*.[51]

Desmodium triflorum: Girish Gowda *et al* [52] revealed that *D. triflorum* possesses a significant dose dependent anticonvulsant activity when used in animal models of epilepsy.

***Emblica officinalis*:** Hydroalcoholic extract of *E. officinalis* administered to rats was evaluated on pentylenetetrazole (PTZ) induced seizures, cognitive deficit and oxidative stress markers and results in completely abolished the generalized tonic seizures and improved the retention latency in passive avoidance task as well as ameliorated the oxidative stress induced by PTZ.[53]

Erythrina variegate: Aqueous extract of *Erythrina variegate* showed significant anxiolytic and anticonvulsant activity, also showed significant modulation of GABA levels in cerebellum and also in whole brain other than cerebellum.[54]

Ficus sp.: Dhanasekaran Sivaraman and Palayan Muralidaran *et al* [55] suggested that potencially antiepileptic compounds are present in the methanol leaf extract of *Ficus hispida*. Damanpreet Singh *et al* [56] concluded that the hydroethanolic extract of adventitious roots of *Ficus religiosa* has anticonvulsant activity. Retention of anticonvulsant effect in the saponins-rich fraction-treated animals indicated the role of saponins for the activity. Minal S. Patil *et al* [57] suggested that an orally administered aqueous root extract of *Ficus religiosa* has anticonvulsant activities against strychnine- and pentylenetetrazole-induced seizures. The appreciable content of zinc and magnesium in the extract may be ascribed to the observed activities. Damanpreet Singh and Rajesh Kumar Goel *et al* [58] suggested that the methanolic extract of figs of *Ficus religiosa* had anticonvulsant activity against MES and picrotoxin induced convulsions, with no neurotoxic effect.

Glycyrrhiza glabra: The ethanolic extract of *G. glabra* inhibits PTZ and lithium-pilocarpine-induced convulsions in albino rats and mice.[59] Other study showed that glycyrrhizic acid has anticonvulsant action when used in Pentylenetetrazole and Isoniazid induced convulsions.[60] The extract and the fractions of *G. glabra* var.*glandulifera* showed anticonvulsant effect in PTZ test.[61]

Hemidesmus indicus: The ethanolic extract of *H. indicus* had reduced the duration of tonic extensor phase and postictal depression in maximal electro shock method and the duration of clonus in pentylenetetrazol method and showed antiepileptic activity.[62]

Hypericum perforatum: The extracts of *H. perforatum* aerial parts were evaluated and showed anticonvulsant effect and this effect may be partially mediated by nitric oxide pathway.[63]

Hyoscymus niger: Methanolic extract of *H. niger* posses the anticonvulsant activity against picrotoxin-induced seizures in mice.[64]

Indigofera tinctoria: The methanolic (90%) extract of *Indigofera tinctoria* was screened for antiepileptic activity on maximal electroshock (MES) and pentylenetetrazole (PTZ) induced seizures models in albino wistar rats and showed significant antiseizure activity.[65] In another study, the ethanol extract of *Indigofera tinctoria* was found to be useful in controlling lithium/pilocarpine-induced status epilepticus in albino rats.[66]

Mimosa pudica: The decoction of *Mimosa pudica* leaves given intraperitoneally at dose of 1000-4000 mg/kg protected mice against pentylentetrazol and strychnine-induced seizures which showed anticonvulsant activity.[67]

Moringa oleifera: Amrutia Jay N *et al* [68] indicates that methanolic extract of *M. oleifera* leaves showed anticonvulsant activity during study and hence may help to control grand mal and petit mal epilepsy.

Mucuna pruriens*: M. pruriens* (100 mg/kg) had significant anticataleptic and antiepileptic activity in haloperidol-induced catalepsy, maximum electro-shock method, pilocarpine-induced status epilepticus.[69]

Myristica fragrans: The extract of *M. fragrans* exhibited anticonvulsant activity against maximum electroshock, pentylenetetrazol, picrotoxin, and lithium sulphate-pilocarpine nitrate during trail.[70] Second trail results indicate that nutmeg oil may be effective against grand mal and partial seizures.[71]

Nardostachys jatamansi: Ethanol extract of the roots of *N. jatamansi* showed significant anticonvulsant activity against maximum electroshock seizure in rats.[72] The herbal extract of *N. jatamansi* also has sedative and anxiolytic effect when trailed in rats.[73] Ethanolic extract of *N. jatamansi* noticed memory restorative when administered young and aged mice.[74]

Nerium oleander: Different extracts of *N. Oleander* showed significant anticonvulsant activity in maximal electro shock and pentylene tetrazole induced convulsions in a dose dependent manner.[75]

Nigella sativa: The constituents of *N. sativa* seed were evaluated for anticonvulsant activity using pentylenetetrazole (PTZ) and maximal electroshock (MES)-induced convulsions and showed varying degree of anticonvulsant activity.[76]

Nilumbo nucifera: *N. nucifera* have mild to moderate anticonvulsant property when evaluated in mice and may be due to involvement of GABA.[77]

Ocimum sp.: Different extracts of stem, leaf and stem callus of *O. sanctum* were tested and showed anticonvulsant activity using maximal electroshock (MES) model.[78] C. O. Okoli *et al* [79] findings suggest that extracts of *Ocimum gratissimum* plant possess anticonvulsant and anxiolytic-like properties during evaluation in mice.

Pongamia pinnata: The anticonvulsant efficacy of the leaf extract of *P. pinnata* was investigated by using maximal electroshock-induced seizure (MES) in mice and findings indicate the anticonvulsant action of *P. pinnata*, probably due to the presence of flavonoids.[80] In other study, by Petroleum ether extract of *P. pinnata* stem bark (800 mg/kg) and its fractions possesses anticonvulsant activity against PTZ and MES induced convulsions.[81]

Pueraria tuberose: The alcoholic extract of tubers of *P. tuberosa* anticonvulsant activity was tested by using maximal electroshock (MES), pentalene tetrazole (PTZ), strychinine induced convulsions and findings suggested anticonvulsant property. [82]

Ricinus communis: The anticonvulsant activity of the isolated compound of *R. communis* was evaluated in mice using the maximal electroshock (MES) model which noticed significantly ($p < 0.05$) reduction of convulsion by MES-induced seizures in albino mice when compared with the standard drug diazepam.[83]

Rubia cordifolia: Triterpene (isolated from the acetone soluble part of petroleum ether extract of *R. cordifolia*) inhibited seizures induced by maximum electro shock, electrical kindling, pentylenetetrazol, and lithium-pilocarpine in rats and mice.[84]

Saussurea lappa**:** *S. lappa* roots's petroleum ether extract possesses anticonvulsant activity against pentylenetetrazole and picrotoxin-induced convulsions in mice, by elevating the seizure threshold through GABAergic the mechanism during study.[85] The ethanolic extract of the root of *S. lappa* exhibited significant anticonvulsant activity in maximal electroshock induced convulsions and pentylenetetrazol-induced clonic convulsions in Swiss albino mice.[86]

Sesbania grandiflora: The triterpene containing fraction of *S. grandiflora* exhibits anticonvulsant profile and anxiolytic activity when used seizures in mice.[87]

Smilax sp.**:** Ethanolic extract and ethyl acetate fraction of the rhizome of *Smilax china* reduced maximal electroshock (MES) and pentylenetetrazole (PTZ)-induced seizures in mice.[88] Similar antiepileptic activity of alcohol and aqueous extracts of roots and rhizomes of *Smilax zeylanica* noticed in trail of *Smilax zeylanica* when in Swiss albino mice.[89]

Solanum nigrum: The aqueous extract of the leaves of *S. nigrum* in chicks, mice and rats possessed anticonvulsant property[90].

Solanum surattense: Methanolic and aqueous extracts of whole plant of *S. surattense* possess the anticonvulsant activity when used against MES and PTZ induced seizures in rats.[91]

Sphaeranthus indicus: The hydroalcoholic extract of the *S. indicus* demonstrated anticonvulsant as well as

anxiolytic and central nervous depressant activities in trail rodents. [92]

***Tephrosia purpurea*:** The ethanolic extract of *T. purpurea* was found to be useful to control lithium-pilocarpine induced status epilepticus in albino rats of Wistar strain.[93]

Terminalia chebula: The ethanolic extracts of *T. chebula* noticed the anticonvulsant activity against MES and PTZ induced seizures in rats.[94]

Vitex negundo: The alcoholic extract of root of *V. negundo* showed anticonvulsant activity in mice by using electroshock and PTZ methods.[95] The ethanolic leaf extract of *V. Negundo noticed* anticonvulsant activity in maximal electroshock seizures (MES) in albino rats and pentylenetetarazole (PTZ) induced seizures in albino mice.[96]

***Withania somnifera*:** The root extract of *W. somnifera* pre-treatment enhanced the antiepileptic effect of diazepam and clonazepam as well as showed anticonvulsant activity in a lithium-pilocarpine model of status epilepticus in rats.[97] In another study, *W. somnifera* showed anticonvulsant effect against PTZ seizure threshold.[98]

Zanthoxylum armatum: Essential oils of the leaves of *Z. armatum* noticed antinociceptive and anticonvulsant activities.[99]

***Zizyphus jujuba*:** The hydroalcoholic extract of *Z. jujuba* demonstrates the anticonvulsant effect as well as amelioration of cognitive impairment induced by seizures in rats.[100]

CONCLUSION

An epileptic seizure or fit is caused by a transient, excessive and abnormal discharge of nerve cells. It is clearly a major public health problem. Ayurveda is a traditional Indian medicinal system being practiced for thousands of years. So, the alternative drug therapy for the management of this disease can be by the use of medicinal plants and their active principles. Thus it may be concluded that herbal drugs make anticonvulsant treatment more rational and patient friendly. Modern and Ancient medicine systems should be combined to plan effective health-care delivery systems for better epilepsy care. In the present review article, selected plants reported to possess anticonvulsant activity. These were trailed in experimental animals, so these herbal plants should be used in appropirate formulations to verify their anticonvulsant activities.

REFERENCES

1. Pandit Kashinatha Shastri and Dr. Gorakha Natha Chaturvedi, editor, Charaka Samhita of Agnivesa elaborated 'Vidyotini' Hindi commentary, Part-II, Chaukhambha Bharati Academy, Varanasi-221001 (India) reprint year: 2006, pp 328-331.
2. Brahmanand Tripathi, editor, Astang Hrdayam of Srimadvagbhata, Edited with 'Nirmala' Hindi Commentary, Chaukhamba Sanskrit Pratishthan, Delhi, Reprint edition 2009, pp 929-932.
3. OP Ghai, Piyush Gupta, VK Paul. Ghai Essential Pediatrics. 6th Edition, New Delhi, CBS Publishers & Distributors Pvt. Ltd, 2004, pp 509-13.
4. Kaviraj Ambikadutta Shastri, editor, Susruta Samhita edited with 'Ayurveda Tattva Sandipika' Hindi commentary, Part-II, Chaukhambha Sanskrit Sansthan, Varanasi, edition reprint-2006, pp 444-450.
5. Kaviraj Ambika Dutt Shastri, Rajeshwar Dutt Shastri, editors, Bhaisjyaratnavali, Hindi commentary, Chaukhambha Sanskrit Sansthana, Varanasi (India), 7th edition, pp 370-373.
6. Gopalakrishna HN, Sudhakar Pemminati, Shilin Giri, Ashok K Shenoy, GKS Holla, Vinod Nair, Alwar MC, Sheethal D. Ullal. Effect of *Acorus calamus* on electrical and chemical induced seizures in mice. IJABPT 2010;1(2)
7. V Pandy, N Jose, H Subhash. CNS Activity of methanol and acetone extracts of *Acorus calamus* leaves in mice. Journal of Pharmacology and Toxicology 2009;4: 79-86. http://dx.doi.org/10.3923/jpt.2009.79.86
8. R Hazara, K Ray, D Guha. Inhibitory role of *Acorus calamus* in ferric chloride–induced epileptogenesis in rat. Hum Exp Toxicol 2007;26(12):947-953. PMid:18375638
9. VS Kasture, CT Chopde, VK Deshmukh. Anticonvulsive activity of *Albizzia lebbeck*, *Hibiscus rosa sinesis* and *Butea monosperma* in experimental animals. J. of Ethnopharmacol 2000;71(2):65-75.http://dx.doi.org/10.1016/S0378-8741(99)00192-0
10. HD Une, VP Sarveiya, SC Pal, VS Kasture, SB Kasture. Nootropic and anxiolytic activity of saponins of *Albizzia lebbeck* leaves. Pharmacol Biochem Behav. 2001;69(3-4):439-44. http://dx.doi.org/10.1016/S0091-3057(01)00516-0
11. Monika Pahuja, Jogender Mehla, KH Reeta, Sujata Joshi, Yogendra Kumar Gupta. Root extract of *Anacyclus pyrethrum* ameliorates seizures, seizure-induced oxidative stress and cognitive impairment in experimental animals. Epilepsy Research 2012;98(2-3):157-65. http://dx.doi.org/10.1016/j.eplepsyres.2011.09.006 PMid:21993359
12. Neeraj Choudhary, Krishna Reddy V Bijjem, Ajudhia N Kalia. Antiepileptic potential of flavonoids fraction from the leaves of *Anisomeles malabarica*. Journal of Ethnopharmacology 2011;135(2):238-242. http://dx.doi.org/10.1016/j.jep.2011.02.019
13. Pandian Nagakannan, Basavaraj D. Shiasharan, Veeresh P. Veerapur, Boreddy S. Thippeswamy. Sedative and antiepileptic effects of *Anthocephalus cadamba* Roxb. in mice and rats. Indian J Pharmacol. 2011;43(6):699-702. PMid:22144777 PMCid:3229788
14. NS Vyawahare, SL Bodhankar. Anticonvulsant activity of *Argyreia speciosa* in mice. Indian J Pharm Sci. 2009;1(2):31-134.
15. Nikunj B Patel, Varsha J Galani, Bharat Kumar G Patel. Antistress activity of *Argyreia speciosa* roots in experimental animals. J Ayurveda Integr Med. 2011;2(3):129-136. PMid:22022155
16. Jalalpure SS, Varsha Bagewadi, Imtiyaz Shaikh. Antiepileptic effect of *Asparagus racemosus* root extracts. Journal of Tropical Medicinal Plants 2009;10(2):157-161.
17. Reas Khan, Amee Krishnakumar, CS Paulose. Decreased glutamate receptor binding and NMDA R1 gene expression in hippocampus of pilocarpine-induced epileptic rats: Neuroprotective role of *Bacopa monnieri* extract. Epilepsy & Behavior 2008;12(1):54-60. http://dx.doi.org/10.1016/j.yebeh.2007.09.021
18. Divya Vohora, SN Pal, KK Pillai. Protection from phenytoin-induced cognitive deficit by *Bacopa monniera*, a reputed Indian nootropic plant. Journal of Ethnopharmacology 2000;71(3):383-390. http://dx.doi.org/10.1016/S0378-8741(99)00213-5
19. Zulfkar Latief Qadrie, R Anandan, Md. Mushtaque, K Asok Kumar, Humaira Ashraf. Anthelmintic and anticonvulsant studies of ethanolic extract of *Benincasa hispida* seeds. Pharmacologyonline 2011;2:1298-1302.
20. Pravinkumar Bhutada, Yogita Mundhada, Kuldeep Bansod, Pankaj Dixit, Sudhir Umathe, Dharmendra Mundhada. Anticonvulsant activity of berberine, an isoquinoline alkaloid in mice. Epilepsy & Behavior 2010;18(3):207-210. http://dx.doi.org/10.1016/j.yebeh.2010.03.007
21. Hamid Reza Sadeghnia, Sahar Darbarpanah, Seyed Mahmood Hosseini. Effect of berberine on pentylenetetrazol-induced seizures in rats. AJP 2011;1(2).
22. Mandeep Kaur, Rajesh Kumar Goel. Anti-convulsant activity of *Boerhaavia diffusa*: plausible role of calcium channel antagonism. Evidence Based Complementary and Alternative Medicine 2009;2011: 7 pages.
23. Achliya GS, Wadodkar SG, Dorle AK. Evaluation of CNS activity of Bramhi Ghrita. Indian J Pharmacol 2005;37:33-6. http://dx.doi.org/10.4103/0253-7613.13853
24. Shukia B, Khanna NK, Godhwani JL. Effect of Brahmi Rasayan on the central nervous system. J Ethnopharmacol. 1987;21(1):65-74. http://dx.doi.org/10.1016/0378-8741(87)90095-X
25. Veena S Kasture, SB Kasture, CT Chopde. Anticonvulsive activity of *Butea monosperma* flowers in laboratory animals. Pharmacology

Biochemistry and Behavior 2002;72(4):965-972. http://dx.doi.org/10.1016/S0091-3057(02)00815-8
26. NI Baek, SG Jeon, EM Ahn, JT Hahn, JH Bahn, JS Jang, SW Cho, JK Park, SY Choi. Anticonvulsant compounds from the wood of *Caesalpinia sappan* L. Archives Of Pharmacal Research 2000;23(4):344-348. http://dx.doi.org/10.1007/BF02975445 PMid:10976581
27. Dinesh Kumar, Jitender Singh, Anupama Baghotia, Sunil Kumar. Anticonvulsant effect of the ethanol extract of *Caesalpinia pulcherrima* (L.) Sw., Fabaceae, leaves. Rev. Bras. Farmacogn. 2010;20(5).
28. Ameeta Argal, Anupam Kumar Pathak. CNS activity of *Calotropis gigantea* roots. Journal of Ethnopharmacology 2006;106(1):142-145. http://dx.doi.org/10.1016/j.jep.2005.12.024 PMid:16446065
29. Subhas S Karki, Suresh Babu AR. Studies on anti-convulsant activity of stem barks of *Calotropis gigantean* Linn. in experimental animals. International Journal of Pharmaceutical Sciences Review and Research 2010;5(1).
30. Ivan Izquierdo, Otto A. Orsingher, Antonio C. Betardi. Effect of cannabidiol and of other *Cannabis sativa* compounds on hippocampal seizure discharges. Psychopharmacology 1973;28(1):95-102. http://dx.doi.org/10.1007/BF00413961
31. P Ghosh, SK Bhattacharya. Anticonvulsant action of cannabis in the rat: role of brain monoamines. Psychopharmacology 1978;59):293-297.
32. Ralph Karler, William Cely, Stuart A Turkanis. The anticonvulsant activity of cannabidiol and cannabinol. Life Sciences 1973;13(11):1527-1531. http://dx.doi.org/10.1016/0024-3205(73)90141-0
33. McCaughran James A, Corcoran Michael ., Wada Juhn A. Anticonvulsant activity of D8- and D9-tetrahydrocannabinol in rats. Pharmacology, Biochemistry and Behavior 1974;2(2):227-233. PMid:4829599
34. Manoj Goyal, BP Nagori, D. Sasmal. Sedative and anticonvulsant effects of an alcoholic extract of *Capparis decidua*. Journal of Natural Medicine 2009;63(4):375-379. http://dx.doi.org/10.1007/s11418-009-0339-3 PMid:19452247
35. SK Mishra, PN Singh, SD Dubey. Anticonvulsant study of *Capparis zeylanica* Linn. root in wistar rats. Research Journal of Medicinal Plant, 2012;6: 416-424. http://dx.doi.org/10.3923/rjmp.2012.416.424
36. Gl Viswanatha, K Nandakumar, Shylaja H, Ramesh C, Rajesh S, R Srinath. Anxiolytic and anticonvulsant activity of alcoholic extract of heart wood of *Cedrus deodara* Roxb. in rodents. JPRHC 2009;1(2):217-239.
37. M.Bhanumathy, MS. Harish, HN Shivaprasad, G Sushma. Nootropic activity of *Celastrus paniculatus* seed. Pharmaceutical Biology 2010;48(3):324-327. http://dx.doi.org/10.3109/13880200903127391 PMid:20645820
38. G. Visweswari, KS Prasad, PS Chetan, V. Lokanatha, W. Rajendra. Evaluation of the anticonvulsant effect of *Centella asiatica* (Gotu Kola) in pentylenetetrazol-induced seizures with respect to cholinergic neurotransmission. Epilepsy & Behavior 2010;17(3):332-335. http://dx.doi.org/10.1016/j.yebeh.2010.01.002
39. Visweswari G, Siva Prasad K, Lokanatha V, W. Rajendra. The antiepileptic effect of *Centella asiatica* on the activities of Na+/K+, Mg2+ and Ca2+-ATPases in rat brain during pentylenetetrazol induced epilepsy. Indian J Pharmacol. 2010;42(2):82–86. PMid:20711371 PMCid:2907020
40. YK Gupta, MH Veerendra Kumar, AK Srivastava. Effect of *Centella asiatica* on pentylenetetrazole-induced kindling, cognition and oxidative stress in rats. Pharmacology, Biochemistry and Behavior 2003;74:579-585. http://dx.doi.org/10.1016/S0091-3057(02)01044-4
41. E Ngo Bum, GT Ngoupaye, E Talla, T Dimo, GC N Nkantchoua, MM Pelanken, GS Taiwe. The anticonvulsant and sedative properties of stems of *Cissus quadrangularis* in mice. African Journal of Pharmacy and Pharmacology 2008;2(3):42-47.
42. Pal D, Sannigrahi S, Mazumder UK. Analgesic and anticonvulsant effects of saponin isolated from the leaves of *Clerodendrum infortunatum* Linn. in mice. IJEB 2009;47(9):743-7.
43. Sudipta Das, Pallab K. Haldar, Goutam Pramanik, Siva P. Panda, Samit Bera. Anticonvulsant activity of methanolic extract of *Clerodendron infortunatum* Linn. in Swiss albino mice. Thai J. Pharm. Sci. 2010;34:129-133.
44. Verma S, Sinha R, Kumar P, Amin F, Jain J, Tanwar S. Study of *Convolvulus pluricaulis* for antioxidant and anticonvulsant activity. Cent Nerv Syst Agents Med Chem. 2012;12(1):55-9.
45. Bihaqi SW, Sharma M, Singh AP, Tiwari M. Neuroprotective role of *Convolvulus pluricaulis* on aluminium induced neurotoxicity in rat brain. Journal of Ethnopharmacology 2009;124(3):409-15. Epub 2009 Jun 6. http://dx.doi.org/10.1016/j.jep.2009.05.038 PMid:19505562
46. Orellana Paucar AM, Serruys AS, Afrikanova T, Maes J, De Borggraeve W, Alen J, Leon Tamariz F, Wilches Arizabala IM, Crawford AD, de Witte PA, Esguerra CV. Anticonvulsant activity of bisabolene sesquiterpenoids of *Curcuma longa* in zebrafish and mouse seizure models. Epilepsy & Behavior 2012;24(1):14-22. http://dx.doi.org/10.1016/j.yebeh.2012.02.020
47. Jithendra Chimakurthy, Talasila EGK Murthy, Lokesh Upadhyay. Effect of curcumin on sub-therapeutic doses of AED'S and long term memory in mice induced GTC type of seizures in rats. Research J. Pharm. and Tech. 2008;1(4).
48. Porwal Mayur, Prakash Pawan, Saxena Ashwin, Sharma Pravesh. Evaluation of anticonvulsant activity of roots and rhizomes of *Cyperus rotundus* Linn. in mice. IRJP 2011;2(10):37-41.
49. Shivkumar SI, Suresh HM, Hallikeri CS, Hatapakki BC, Handiganur JS, Kuber Sankh, Shivakumar B. Anticonvulsant effect of *Cyperus rotundus* Linn rhizomes in rats. Journal of Natural Remedies 2009;9(2):192-196.
50. Mohsen Khalili, Zahra Kiasalari, Mehrdad Roghani, Yaser Azizi. Anticonvulsant and antioxidant effect of hydroalcoholic extract of *Cyperus rotundus* rhizome on pentylentetrazole-induced kindling model in male mice. J. Med. Plant. Res 2011;5(7):1140-1146.
51. Raza M, Shaheen F, Choudhary MI, Sombati S, Rafiq A, Suria A, Rahman A, DeLorenzo RJ. Anticonvulsant activities of ethanolic extract and aqueous fraction isolated from *Delphinium denudatum*. J Ethnopharmacol. 2001;78(1):73-8. http://dx.doi.org/10.1016/S0378-8741(01)00327-0
52. Girish Gowda, Kuntal Das, Vaibhav Bhosle, John Wilking Einstein, Benson Mathai K. Evaluation of anticonvulsant activity of ethanolic leaves extract of *Desmodium triflorum* in mice. Rev. Bras. Farmacogn. 2012;22(3).
53. Golechha Mahaveer, Bhatia Jagriti, Arya Dharamvir Singh. Hydroalcoholic extract of *Emblica officinalis* Gaertn. affords protection against PTZ-induced seizures, oxidative stress and cognitive impairment in rats. IJEB 2010;48(5):474-478.
54. G Pitchaiah, GL Viswanatha, R Srinath, K Nandakumar, D Dayabaran, EJ Florance. Anxiolytic and anticonvulsant activity of aqueous extract of stem bark of *Erythrina variegata* in rodents. Int. J. Pharm Tech Res.2010,2(1):40-48.
55. Dhanasekaran Sivaraman, Palayan Muralidaran. Sedative and anticonvulsant activities of the methanol leaf extract of *Ficus hispida* Linn. Drug Invention Today 2009;1(1):23-27.
56. Damanpreet Singh, Bikram, Rajesh Kumar Goel. Role of saponins for the anticonvulsant effect of adventitious roots of *Ficus religiosa*. Pharmaceutical Biology 2012;50(7):816-822. http://dx.doi.org/10.3109/13880209.2011.636057 PMid:22471888
57. Minal S Patil, CR Patil, SW Patil, RB Jadhav. Anticonvulsant activity of aqueous root extract of *Ficus religiosa*. Journal of Ethnopharmacology 2011;133(1):92-96. http://dx.doi.org/10.1016/j.jep.2010.09.004 PMid:20837125
58. Damanpreet Singh, Rajesh Kumar Goel. Anticonvulsant effect of *Ficus religiosa*: Role of serotonergic pathways. Journal of Ethnopharmacology 2009;123(2):330-334. http://dx.doi.org/10.1016/j.jep.2009.02.042 PMid:19429380
59. Shirish D Ambawade, Veena S Kasture, Sanjay B Kasture. Anticonvulsant activity of roots and rhizomes of *Glycyrrhiza glabra*. Indian Journal of Pharmacology 2002;34:251-255.
60. Kale Shubhangi S, Shete Rajkumar V, Kore Kakasaheb J, Patil Bhaskar M. Bhutada Rupesh. N., Pattankude Vinod. S. Anticonvulsant activity of glycyrrhizic acid in mice. IJPRD 2010;2(10).
61. Azadeh Yazdi, Soroush Sardari, Mohammad Sayyah, Majid Hassanpour Ezzati. Evaluation of the anticonvulsant activity of the leaves of *Glycyrrhiza glabra* var. *glandulifera* grown in Iran, as a possible renewable source for anticonvulsant compounds. IJPR 2011;10(1):75-82.
62. M Malathi, B Maharani. Evaluation of anticonvulsant activity of ethanolic extract of roots of *Hemidesmus indicus* using adult albino rats. Journal of Pharmacy Research 2011;4(10).

63. Hossein Hosseinzadeh, Gholam Reza Karimi, Maysam Rakhshanizadeh. Anticonvulsant effect of *Hypericum perforatum*: role of nitric oxide. Journal of Ethnopharmacology 2005;98(1-2):207-208. http://dx.doi.org/10.1016/j.jep.2004.12.007 PMid:15763385
64. Reza HM, Mohammad H, Golnaz E, Gholamerza S. Effect of methanolic extract of *Hyoscymus niger* L. on the seizure induced by picritoxin in mice. Pak J Pharm Sci. 2009;22(3):308-12. PMid:19553180
65. Saravana Kumar A, Madhan Mohan E, Gandhimathi R, Amudha P. Study on the Anti-Seizure activity of methanolic extracts of *Indigofera tinctoria* (L.). Pharmacologyonline 2009;1:1341-1351.
66. G Asuntha, Y Prasannaraju, KVSRG Prasad. Effect of ethanol extract of *Indigofera tinctoria* Linn (Fabaceae) on lithium/pilocarpine induced status epilepticus and oxidative stress in wistar rats. Tropical Journal of Pharmaceutical Research 2010;9(2). http://dx.doi.org/10.4314/tjpr.v9i2.53702
67. E Ngo Bum, DL Dawack, M Schmutz, A Rakotonirina, SV Rakotonirina, C Portet, A Jeker, HR Olpe, P Herrling. Anticonvulsant activity of *Mimosa pudica* decoction. Fitoterapia 2004;75(3-4):309-314. http://dx.doi.org/10.1016/j.fitote.2004.01.012 PMid:15158987
68. Amrutia Jay N, Lala Minaxi, Srinivasa U, Shabaraya AR, Moses Rajan Semuel. Anticonvulsant activity of *Moringa oleifera* leaf. International Research Journal of Pharmacy 2011;2(7):160-162.
69. Champatisingh D, Sahu PK, Pal A, Nanda GS. Anticataleptic and antiepileptic activity of ethanolic extract of leaves of *Mucuna pruriens*: A study on role of dopaminergic system in epilepsy in albino rats. Indian J Pharmacol 2011;43(2):197-9. http://dx.doi.org/10.4103/0253-7613.77368 PMid:21572658 PMCid:3081462
70. GS Sonavane, RC Palekar, VS Kasture, SB Kasture. Anticonvulsant and behavioural actions of *Myristica fragrans* seeds. Indian Journal of Pharmacology 2002;34:332-338
71. Wahab A, UI Haq, Ahmed A, Khan RA, Raza M. Anticonvulsant activities of nutmeg oil of *Myristica fragrans*. Phytother Res. 2009;23(2):153-8. http://dx.doi.org/10.1002/ptr.2548 PMid:19067329
72. Vidya S. Rao, Anjali Rao, K. Sudhakar Karanth. Anticonvulsant and neurotoxicity profile of *Nardostachys jatamansi* in rats. Journal of Ethnopharmacology 2005;102(3):351-35. PMid:16095854
73. Rezaei Ali, Pashazadeh M, Ahmadizadeh Ch, Jafari Behboud, Jalilzadeh Hedayati M. Study of sedative and anxiolytic effect of herbal extract of *Nardostachys jatamansi* in comparison with diazepam in rats. Journal of Medicinal Plants 2010;9(36):169-174.
74. Hanumanthachar Joshi, Milind Parle. *Nardostachys jatamansi* improves learning and memory in mice. Journal of Medicinal Food. 2006;9(1):113-118. http://dx.doi.org/10.1089/jmf.2006.9.113 PMid:16579738
75. Rout Susanta Kumar, Kar Durga Madhab. An experimental evaluation of anticonvulasant activity of *Nerium oleander* leaf extract. IRJP 2011;2(10):73-75.
76. Muhammad Raza, Abdullah A. Alghashan, Mohammad S. Alorainy, Tarig M. El Hadiyah. Potentiation of valproate induced anticonvulsant response by *Nigella sativa* seed constituents: the role of GABA receptors. Int J Health Sci (Qassim). 2008;2(1):15-25.
77. Maharshi K Joshi, Harsh B Joshi, Kruti T Joshi, Ujjawal T Joshi, Hemangini B. Joshi. Anticonvulsant activity of *Nilumbo nucifera*. IJPRD 2011;3(1).
78. Jaggi RK, Madaan R, Singh B. Anticonvulsant potential of holy basil, *Ocimum sanctum* Linn., and its cultures. Indian J Exp Biol 2003;41(11):1329-33. PMid:15332507
79. CO Okoli, AC Ezike, OC Agwagah, PA Akah. Anticonvulsant and anxiolytic evaluation of leaf extracts of *Ocimum gratissimum*, a culinary herb. Pharmacognosy Res. 2010;2(1):36-40. http://dx.doi.org/10.4103/0974-8490.60580 PMid:21808537 PMCid:3140126
80. Ashish Manigauha, Sunita Patel, Jitender Monga, Huma Ali. Evaluation of anticonvulsant activity of *Pongamia pinnata* Linn in experimental animals. International Journal of Pharm Tech Research 2009;1(4):1119-1121.
81. Anup S Ramdhave, Sachin L Badole, Subhash L. Bodhankar. Anticonvulsant activity of stem bark of *Pongamia pinnata*. Biomedicine & Aging Pathology 2011;1(3):147-157.
82. Basavaraj P, Shivakumar B, Shivakumar H. Evaluation of anticonvulsant activity of alcoholic extract of tubers of *Pueraria tuberosa* (Roxb). Adv. Pharmacol. Toxicol. 2011;12(1):1-9.
83. Avinash Chandra Tripathi, Rajiv Gupta, Shailendra K. Saraf. Phytochemical investigation characterisation and anticonvulsant activity of *Ricinus communis* seeds in mice. Natural Product Research: Formerly Natural Product Letters 2011;25(19).
84. VS Kasture, VK Deshmukh, CT Chopde. Anticonvulsant and behavioural actions of triterpene isolated from *Rubia cordifolia* Linn. IJEB 2000;38(7):675-80.
85. Shirishkumar D Ambavade, Nilesh A Mhetre, Amol P Muthal, Subhash L Bodhankar. Pharmacological evaluation of anticonvulsant activity of root extract of *Saussurea lappa* in mice. European Journal of Integrative Medicine 2009;1(3):131-137.
86. Gupta Pushpraj S, Jadhav SS, Ghaisas MM, Deshpande AD. Anticonvulsant activity of *Saussurea lappa*. Pharmacologyonline 2009;3:809-814.
87. Veena S Kasture, VK Deshmukh, CT Chopde. Anxiolytic and anticonvulsant activity of *Sesbania grandiflora* leaves in experiment animals. Phytother Res. 2002;16(5):455-60. http://dx.doi.org/10.1002/ptr.971 PMid:12203267
88. A Vijaylakshmi, V Ravichandiran, J Anbu, Malarkodi Velraj, S Jayakumari. Anticonvulsant and neurotoxicity profile of the rhizome of *Smilax china* Linn. in mice. Indian J Pharmacol. 2011;43(1):27-30. http://dx.doi.org/10.4103/0253-7613.75662 PMid:21455417 PMCid:3062115
89. V Madhavan, Hemalatha HT, Anita Murali, SN Yoganarasimhan. Antiepileptic activity of alcohol and aqueous extracts of roots and rhizomes of *Smilax zeylanica* Linn. Pharmacologyonline 2008;3:263-272.
90. Wannag NN, Anuka JA, Kwanashie HO, Gyang SS, Auta A. Antiseizure activity of the aqueous leaf extract of *Solanum nigrum* Linn. (Solanaceae) in experimental animals. Afr Health Sci. 2008;8(2):74-9. PMid:19357754 PMCid:2584323
91. RB Birari, MV Tote, SA Patil, SS Jalalpure, SL Shid, BM Habade. Anticonvulsant activity of whole plant of *Solanum surattense* Burm. against MES and PTZ induced seizures in rats. Pharmacologyonline 2010;1:479-486.
92. Galani VJ, Patel BG. Effect of hydroalcoholic extract of *Sphaeranthus indicus* against experimentally induced anxiety, depression and convulsions in rodents. Int J Ayurveda Res. 2010;1(2):87-92. http://dx.doi.org/10.4103/0974-7788.64412 PMid:20814521 PMCid:2924989
93. Asuntha G, Prasannaraju Y, Sujatha D, Prasad Kvsrg. Assessment of effect of ethanolic extract of *Tephrosia purpurea* (L.) Pers., Fabaceae, activity on lithium-pilocarpine induced status epilepticus and oxidative stress in wistar rats. Rev. bras. farmacogn. 2010;20(5)
94. G Hogade Maheshwar, SV Deshpande, HJ Pramod. Anticonvulsant activity of fruits of *Terminalia chebula* Retz. against MES and PTZ induced seizures in rats. Journal of Herbal Medicine and Toxicology 2010;4(2):123-126
95. P Singh, G Mishra, VK Garg, KK Jha, RL Khosa. Phytochemical screening and anticonvulsant activity of alcoholic extract of root of *Vitex negundo*. International Journal of Pharmaceutical Research and Innovation, 2011;4:16-19
96. Tandon VR, Gupta RK. An experimental evaluation of anticonvulsant activity of *Vitex negundo*. Indian J Physiol Pharmacol 2005;49(2):199-205. PMid:16170989
97. K Kulkarni, B George, R Mathur. Protective effect of *Withania somnifera* root extract on electrographic activity in a lithium-pilocarpine model of status epilepticus. Phytotherapy Research 1998;12(6):451-453. http://dx.doi.org/10.1002/(SICI)1099-1573(199809)12:6<451::AID-PTR328>3.0.CO;2-C
98. Kulkarni, SK Akula, Kiran Kumar Dhir, Ashish. Effect of *Withania somnifera* Dunal root extract against pentylenetetrazol seizure threshold in mice: Possible involvement of GABAergic system. IJEB 2008;46(6):465-469.
99. Muhammad Ibrar, Naveed Muhammad, Barkatullah, Haroon Khan, Faryal Jahan, Nadeem Ashraf. Antinociceptive and anticonvulsant activities of essential oils of *Zanthoxylum armatum*. Phytopharmacology 2012, 3(1) 191-198.
100. Monika Pahuja, Jogender Mehla, KH Reeta, Sujata Joshi, Yogendra Kumar Gupta. Hydroalcoholic extract of *Zizyphus jujuba* ameliorates seizures, oxidative stress, and cognitive impairment in experimental models of epilepsy in rats. Epilepsy & Behavior 2011;21(4):356-363. http://dx.doi.org/10.1016/j.yebeh.2011.05.013

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