



“EFFICACY OF INDIAN TRADITIONAL MEDICINE IN THE TREATMENT OF EPILEPSY”

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Abstract : Epilepsy, a neurological disorder characterized by abnormal brain activity, poses a significant global health problem. While conventional pharmacotherapy is commonly used, it often entails adverse effects, failures causing remission of the disease, and may not target the root cause of epileptogenesis. In regions like India, herbal remedies have gained attention as alternative or complementary treatments due to their relatively high efficacy and least adverse reactions.

Objective: This review delves into providing information on some of the traditional anticonvulsant plants used in India, including *Adhatoda vasica*, *Brassica nigra*, *Cassia fistula*, and others. Scientific validation through multiple epilepsy models has demonstrated their efficacy in reducing seizures, attributed to active constituents within these plants. Integrating these herbal remedies with conventional pharmacotherapy offers a holistic approach to epilepsy management, potentially enhancing patient outcomes and quality of life.

Conclusion: The review summarizes to give a thorough grasp of the ways in which these traditional botanicals can improve patient outcomes and quality of life when combined with conventional medication. Further research and clinical trials are necessary to elucidate mechanisms of action and optimize their use in the treatment of epilepsy.

Keywords – Epilepsy, Neurological disorder, Herbal remedies, epileptogenesis

I. INTRODUCTION

Epilepsy is a neurological disorder characterized by abnormal firing in the brain's neurons. Neurotransmitters largely influence the occurrence and incidence of seizures in this disease. Symptoms of seizures include uncontrolled jerking movements of the arms and legs, loss of consciousness, stiffening of muscles, and fear. The primary factor contributing to convulsions is an imbalance between the key excitatory neurotransmitter Glutamate and the inhibitory neurotransmitter GABA. Other causes can be related to hereditary factors, serious brain injuries, and tumors. Long-term exposure to such endogenous and exogenous variables results in neuroinflammation, which increases the possibility of occurrence and further deteriorates the condition. [1,2].

The prevalence of the appearance of convulsions varies in terms of age, sex, social status, and geological location. Studies reveal that the youngest (<1year) and elderly are most likely to suffer acute symptomatic seizures and the Male population has a higher chance of incidence of seizures compared to females.[3] Where the likelihood of the appearance of convulsions peaked in young children of less than a year, it seemed to decline by the time the kid reached the age of 10. [4]

Pharmacotherapy is the first-line treatment for epilepsy and gives satisfactory guidance on improving patient's quality of life. The choice of monotherapy or polytherapy of medication depends upon the convulsions experienced by the patients. Patients not achieving seizure control are classified as refractory or drug-resistant patients. In such cases alternate therapies such as neurostimulation, ketogenic diet, lifestyle changes, surgery are taken into consideration. However, pharmacotherapy has its pros and cons. Anti-seizure medications are known to be followed with several systemic and neurologic adverse effects such as nausea, vomiting, sleep cycle, and motor disturbances which resulted in patients discontinuing the therapy even in case of controlled seizure. [5]

Plants are considered as an alternative or complementary form of medicine for seizures, in the form of herbal decoctions, acupuncture, infusions, and powders. A few of such historically documented herbal remedies continue to be in use today. As per the 2020 Committee of National Pharmacopeia, there are currently more than 20 traditional Chinese patent remedies available for use in clinical settings, and over the years, a number of newer medicinal plants were found active against epilepsy and its refractory forms. One of the major examples is the plant Cannabidiol. While the cannabis plant has been known to effectively treat convulsions, the purified chemical component Cannabidiol therefore has gained attention for its effectiveness in treating drug-resistant epilepsy of different causes. [6,7]

India has been known for its traditional medicinal practices, and its role in serving global medical needs is crucial. This contribution will continue to play a major role in the future as well. India has the distinct advantage of having six widely accepted Indian medical systems, most of which rely on herbs. Additionally, there are a significant number of healers in the folklore stream who are still not classified under any category.

The use of Western medicine alone to treat convulsions can cause several adverse effects. Furthermore, these treatments only provide symptomatic relief and do not address the root cause of epileptogenesis. As a result, many people in different parts of the world opt for herbal remedies, which have limited or no adverse reactions, in combination with conventional drugs. [8] Herbal medicines composition is complex, and their cure rate may be slower than modern medicine, but they are beneficial in improving the patient's quality of life. This review article focuses on summarizing the traditional anticonvulsant plants used in India and their scientific significance.

II. ROLE OF PHYTOCONSTITUENTS AS AN ANTIPILEPTIC

Plants contain natural phytoconstituents that have antiepileptic properties. For example, plants containing **alkaloids** interfere with Na⁺ gated voltage channels, reducing the potential for epilepsy. Aconitum alkaloids, which are diterpene alkaloids found mainly in the Ranunculaceae family, have demonstrated antiepileptic activity in in vitro studies conducted on rat hippocampal slices. **Flavonoids** are another important group of phytoconstituents. Specific flavonoids apigenin, wogonin, fisetin, baicalin, and vitexin have been shown to exhibit neuroprotective effects by increasing the GABA activity in the brain and protecting the neurons from the oxidative stress.

Terpenoids also known by isoprenoids. monoterpenoids like cannabidiol, citronellol, carvone, eugenol have shown protective effects against seizures induced by PTZ, MES models by modulating neuronal excitability and interacting with GABAergic receptors. **Saponins** *Cynanchum otophyllum*, also known as "scnield," is a traditional Chinese plant used in epilepsy treatment. Otophyllside A,B and 2 C21-steroidal saponins, are the active constituents responsible for the antiepileptic effect. Therefore, saponin extracts from certain plants can be considered beneficial for treating epilepsy. Another plant with saponin extracts exhibiting anticonvulsant properties is *Withania somnifera*.

Coumarins are polyphenolic compounds derived from plants. These compounds have been found to significantly reduce convulsions in animal models of epilepsy (MES) by affecting GABA neurons. Some examples of coumarins with antiepileptic properties include esculetin, imperatorin, and osthole. [9]

III. MATERIALS AND METHODS

The information about the herbs included in this review article is obtained by referring to the main texts on ayurvedic medicine in Indian Materia Medica, Charaka Samhita, and Sushruta Samhita. The electronic data bases namely Pubmed, Google Scholar, Scopus, and Research gate were searched using relevant keywords such as Herbal medicine, Epilepsy, and Convulsions. The outcome of the search showed current scientific findings based on the suggested herbal plants for the study.

IV. RESULTS

Many plants used traditionally in the treatment of epilepsy in India were evaluated and reviewed for their scientific validation of anticonvulsant medication.

3.1 *Adhatoda vasica* Nees

This plant is also known as *Justicia adhatoda* L., is a plant native to Asia and can be found across the Indian subcontinent, Nepal, Bengal, Sri Lanka and other regions. This plant holds significant importance in different traditional medicinal systems such as Ayurveda, Homeopathy, Siddha and Unani due to its wide range of useful properties. [10] The anticonvulsant activity of aqueous *Adhatoda vasica* leaf extract (100, 200mg/kg p.o) was examined in albino mice by using the Pentylene tetrazole model.

6 animals per group and sodium valproate as standard were used for the research. The study showed a protection rate of 33.3% from clonic seizures at a dose of 200mg/kg on the animal concluding that the aqueous extract of *Adhatoda vasica* provides significant protection against the occurrence of seizures, proving its claims as a traditional anticonvulsant. [11]

3.2 *Brassica nigra*

These are commonly known as Black mustard seeds. These seeds have its uses mentioned in folk medicine as a potent medication for epilepsy. In the traditional Iranian system of medicine, it has been used to relieve neuronal pain.

The hydroalcoholic extract of *Brassica nigra* seeds has been used in the increasing dose of concentrations 75, 150, and 300mg/kg intraperitoneally. Male albino mice were kindled using the Pentylene tetrazole model. It was seen that sodium valproate 100mg/kg and *Brassica nigra* at 75mg/kg showed similar seizure-reducing intensity. The research findings indicate that drugs that regulate GABAergic mechanisms and benzodiazepine receptors exhibit anticonvulsant potential, validating their traditional use. [12,13]

3.3 *Cassia fistula*

This is an ornamental tree that produces yellow flowers. The seeds of this tree are used for treating epilepsy by indigenous communities living in the sub-Himalayan regions of Uttarakhand, India. Traditional medical practitioners use two tablespoons of seed decoction orally for this purpose. [14] A research article by Tan Ad, Castillo Al, et al. demonstrates the efficacy of this treatment. The study involved testing the aqueous seed extract of *Cassia fistula* Linn on Swiss albino mice using MES and strychnine-induced convulsive models.

The results revealed that all the doses of 200,400,800 mg/kg showed a dose-dependent decrease in the occurrence of convulsions in MES and strychnine-induced models significantly reducing mortality and proving efficacy. [14,15]

3.4 *Bixa orellana*

This plant is also known as Achiote, a plant native to South and East Asia, India, tropic Africa, and the Philippines. It has a long history of medicinal use, with the decoction of its roots and leaves being used as an anticonvulsant. [16] The plant's seed contain various bioactive compounds, which are known to have pharmacological properties and are used as colorants and spices.

When tested for its antiepileptic potential using MES and PTZ models on experimental animals, the ethanolic extract of *Bixa orellana* seeds showed promising results. At doses of 100, 200, and 400 mg/kg orally, it was found to reduce seizure occurrences in both models, indicating its potential to target various types of epilepsy. [17]

3.5 *Calotropis gigantea*

This plant is used mostly in the traditional Ayurvedic system of medicine in India. It is a perennial subshrub that grows on wastelands and is native to India and other African states. The flowers of the plant are believed to have been used by traditional healers in three different communities to treat epilepsy. Additionally, the stem, leaf, and root of the plant have been found to have significant anticonvulsant properties. [18]

A study conducted by Bairagi SM et al evaluated the anticonvulsant and sedative activity of the ethanolic extract of *Calotropis gigantea*. Convulsions were produced using the strychnine and MES model. The results of the study showed a significant reduction in convulsions induced by the electroshock model in mice, but no effect was observed in the mice where convulsions were induced by the Strychnine powder. [19]

3.6 *Pongamia pinnata*

This plant is renowned for its diverse medicinal properties and is mainly cultivated in the hot regions of Asia, particularly in India. This plant has been mentioned in several ancient texts such as Vedas and Nighantu due to its importance in traditional medicine. The leaf and stem part of the plant have been used for treating epilepsy. The plant contains various active components like flavonoids, tannins, alkaloids, fixed oils, glycosides, Karangin, glabrin and others contributing to its diverse medicinal uses. [20]

A study was conducted on the ethanolic extracts of *Pongamia pinnata* leaves to test its effectiveness against convulsions using the electroshock model. The study found that a dose of 200-400mg/kg significantly reduced the occurrence of convulsions, with the maximum reduction seen at a dose of 400mg/kg. [21]

3.7 *Plumbago indica*

This is a shrub with various therapeutic properties. Traditionally, its roots and leaves have been used to treat paralysis, leprosy, and other skin ailments. The plant's root contains 'plumbagin' an active compound that is essential in treating diseases related to ophthalmia.

The study conducted by Saha R et al aimed to investigate the anticonvulsant activity of *Plumbago indica* L.'s methanolic extract on zebrafish. The experimental setup involved adult zebrafish that were submerged in the *Plumbago indica* L. extract. To induce convulsions, PTZ was administered, and the seizure-like activities observed were categorized and scored based on their varying seizure profiles, severity, and latencies. The findings revealed significant anticonvulsant effects of the extract, as demonstrated by the observed CNS depressant and anticonvulsant effects. [22]

3.8 *Nardostachys jatamansi*

This is an Ayurvedic herb commonly used as a spice and herbal tonic. The powdered roots of the herb have a long history of use as folk medicine for various ailments, including spasms, convulsions, stress, hysteria and other neurological disorders. The oil from this herb is also known to help in hair growth. In India roots and rhizome parts of the herb are marketed under the name of Ayush56. [23]

A recent study investigated the effects of ethanolic root extracts of *Nardostachys jatamansi* on male albino rats using a maximal electroshock model. The rats were administered doses of 200mg/kg and 400mg/kg and observed for any reduction in convulsions. The results showed a decrease in convulsions at a dose of 400mg/kg, indicating the antiepileptic potential of the plant. [24]

3.9 *Lantana camara*

This plant, belonging to the family of Lamiaceae has spread widely throughout Europe, temperate Asian countries, Africa. In India it is commonly found in the Uttarakhand region. It is known for its medicinal efficacy in treating various diseases. The roots, flowers, and leaves are primarily used to treat wounds, inflammation, and ulceration as well as epilepsy, malaria, cancer, and rheumatic disease. The plant contains many bioactive agents like alkaloids, flavonoids, terpenoids, carbohydrates, tannins, and phenols that contribute to its therapeutic effect.

A research study was conducted to assess the antiepileptic properties of *Lantana camara* flowers using various solvent extracts (100,200 mg/kg). The study utilized MES and pentylenetetrazole models. The findings indicated that only the ethanolic and chloroform extracts of the flowers exhibited antiepileptic properties, with the highest and moderate effects being observed at a dose of 200mg/kg. These results support the traditional claims of the plant. [25]

3.10 *Bacopa monneiri*

Bacopa monneiri is a creeper herb known for its therapeutic properties for over 1400 years. It is traditionally used in Ayurveda and is mentioned in the Vedic literature in the management of various disorders. It is believed to be rich in antioxidants and hence effective in neuroprotection. [26]

A research study on the anticonvulsant effect of *Bacopa monneiri* was done on Male Wistar albino rats. The study investigated the effects of different extracts of BM on convulsions induced by PTZ with a focus on cholinergic activity and ATPase in different regions of the brain. The results showed *Bacopa monneiri* had a protective effect by interrupting the pathological mechanism that occurs during epileptogenesis justifying its traditional uses. [27]

3.11 *Rauvolfia serpentina*

This plant is a type of woody shrub that belongs to the Apocynaceae family. It can be found in various habitats across the world. In India, indigenous communities have recognized the medicinal importance of the juice extracted from the roots and leaves, and it has been used to treat neurological conditions for many years. These parts of the plant are also commonly used in the traditional ayurvedic system of medicine. The plant contains N-containing indole alkaloids, which is responsible for most of its medicinal properties.

A study was conducted to determine the anticonvulsant activity of the ethanolic leaf extract of *Rauvolfia serpentina* on Swiss albino mice. The study used a dose range of 100-800 mg/kg and two seizure models, MES and PTZ-induced tonic seizures. The results of the study suggest that the extract has the potential in protecting the animals from seizures. [28]

3.12 *Ziziphus mauritiana*

This plant belonging to a fruit yielding family also known as Indian jujube or Ber, is consumed globally in its dried fruit form. Its herbal formulations have been utilized in the treatment of neurological disorders, as well as for its hepatoprotective, anti-inflammatory, and anticancer properties. These pharmacological effects are mainly due to the presence of phenolic compounds that exert an antioxidant effect against ROS and free radicals.

An experiment was conducted to test the sedative and anticonvulsant effects of the ethanolic extract of *Ziziphus mauritiana* at oral doses of 200mg/kg and 400mg/kg. The results showed that the maximum reduction in locomotion was observed at a dose of 400mg/kg, which supports the traditional use of this extract in various systems. [29]

V. CONCLUSION

The Indian herbs offer a diverse range of medicinal therapies as a potential anticonvulsant. The study reviewed in this article demonstrates the efficacy of the traditional plants being used in the treatment of epilepsy. The plants reviewed are *Adhatoda vasica*, *Brassica nigra*, *Cassia fistula*, *Bixa orellana*, *Calotropis gigantea*, *Pongamia pinnata*, *Plumbago indica*, *Nardostachys jatamansi*, *Lantana camara*, *Bacopa monnieri*, *Rauvolfia serpentina*, and *Ziziphus mauritiana*. The findings validate the antiepileptic potential of the plants. The medicinal plants were tested for their anticonvulsant activity using 2 or more models of epilepsy. For most of the plants the active constituents were found to be responsible for their activity. Integrating these herbal remedies with conventional pharmacotherapy may offer a holistic approach to epilepsy management, potentially improving patient outcomes and quality of life.

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