Journal or Innovative Development in Pharmaceutical and Technical Science (JIDPTS)
Volume:9, Issue:11, Nov:2026

(J I D P T S)
ISSN(O):2581-6934

PHYTOCHEMICAL AND PHARMACOLOGICAL EVALUATION OF ANTILEPTIC ACTIVITY OF ABUTILON INDICUM

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Abstract: The present study was undertaken to evaluate the phytochemical and pharmacological activity of the ethanolic extract of Abutilon indicum for its antiepileptic potential using experimental animal models. Preliminary phytochemical screening of the extract revealed the presence of flavonoids, alkaloids, tannins, phenolic compounds, glycosides, and saponins, which are known for their neuroprotective and antioxidant properties. Acute toxicity studies were performed according to Organization for Economic Co-operation and Development guideline 423, and the extract was found to be safe up to 2000 mg/kg body weight. Based on the toxicity results, doses of 200 mg/kg and 400 mg/kg were selected for pharmacological evaluation. Antiepileptic activity was assessed using the Maximal Electroshock Seizure (MES) model in Wistar albino rats. Behavioral and motor coordination studies were carried out using Open Field and Rotarod tests. The extract exhibited significant dose-dependent antiepileptic activity by improving locomotor activity, exploratory behavior, and motor coordination. Biochemical analysis showed a significant increase in GABA and catalase levels along with a reduction in glutamate concentration and lipid peroxidation levels, indicating reduction of neuronal excitability and oxidative stress. The higher dose (400 mg/kg) showed effects comparable to the standard drug Diazepam. The results of the present investigation suggest that the ethanolic extract of Abutilon indicum possesses significant antiepileptic and neuroprotective activity, which may be attributed to its phytoconstituents with antioxidant properties. The study supports the traditional use of the plant and indicates its potential as a natural therapeutic agent for the management of epilepsy.

Keywords: Abutilon indicum, Antiepileptic activity, Maximal electroshock seizure, Diazepam Phytochemical screening, Neuroprotective activist, Oxidative stress; GABA

INTRODUCTION

Epilepsy is one of the most prevalent neurological disorders globally, affecting over 50 million individuals. Characterized by recurrent, unprovoked seizures, epilepsy often requires long-term pharmacological management. Despite the availability of numerous antiepileptic drugs (AEDs), approximately one-third of patients exhibit resistance to conventional therapies or experience significant adverse effects, prompting the search for alternative and adjunctive treatments. Nigella sativa, commonly known as black seed or black cumin, is a medicinal plant traditionally used in Middle Eastern, Asian, and African systems of medicine. Its seeds contain several bioactive compounds, most notably thymoquinone, which has demonstrated a wide range of pharmacological effects, including antioxidant, anti-inflammatory, and neuroprotective properties. Increasing preclinical and limited clinical evidence suggests that Nigella sativa may exert antiepileptic effects, potentially through mechanisms involving GABAergic modulation, opioid receptor activity, and oxidative stress reduction. Studies in animal models-such as pentylenetetrazol (PTZ), maximal electroshock (MES), and kindling models-have shown that both Nigella sativa extracts and thymoquinone

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can delay seizure onset, reduce seizure severity, and enhance the efficacy of conventional AEDs like valproate. Early human studies, particularly in children with drug-resistant epilepsy, also support its potential as a safe and effective complementary therapy. These findings underscore the promise of Nigella sativa as a novel candidate in the development of adjunctive antiepileptic treatments, though further clinical validation is needed [1-.5] Modern treatment of seizures started in 1850 with the introduction of bromides, which was based on the theory that epilepsy was caused by an excessive sex drive. In 1910, phenobarbital (PHB), which then was used to induce sleep, was found to have antiseizure activity and became the drug of choice for many years. A number of medications similar to PHB were developed, including primidone. In 1938, Houston Merrit and Tracy Putnam described animal models for screening multiple compounds for antiepileptic activity in the Journal of the American Medical Association. In 1940, phenytoin (PHT) was found to be an effective drug for the treatment of epilepsy, and since then it has become a major first-line antiepileptic drug (AED) in the treatment of partial and secondarily generalized seizures. In 1968, carbamazepine (CBZ) was approved, initially for the treatment of trigeminal neuralgia; later, in 1974, it was approved for partial seizures. Ethosuximide has been used since 1958 as a first-choice drug for the treatment of absence seizures without generalized tonic-clonic seizures. Valproate (VPA) was licensed in Europe in 1960 and in the United States in 1978, and now is widely available throughout the world. It became the drug of choice in primary generalized epilepsies and in the mid-1990s was approved for treatment of partial seizures. These anticonvulsants were the mainstays of seizure treatment until the 1990s, when newer AEDs with good efficacy, fewer toxic effects, better tolerability, and no need for blood level monitoring were developed. A study of live-born infants in Denmark found that exposure to the newer-generation AEDs lamotrigine, oxcarbazepine, topiramate, gabapentin, and levetiracetam in the first trimester was not associated with an increased risk in major birth defects. [6] The new AEDs have been approved in the United States as add-on therapy only, with the exception of topiramate and oxcarbazepine (OXC); lamotrigine (LTG) is approved for conversion to monotherapy. A meta-analysis of 70 randomized clinical trials confirms the clinical impression that efficacy does not significantly differ among AEDs used for refractory partial epilepsy. [7] Antiepileptic drugs should be used carefully, with consideration of medication interactions and potential side effects. This is particularly important for special populations, such as patients with HIV/AIDS. [8]

ANTIEPILEPTIC ACTIVITY OF HERBAL PLANTS

Epilepsy is a chronic neurological disorder characterized by recurrent, unprovoked seizures, affecting over 50 million individuals globally. Despite the availability of numerous synthetic antiepileptic drugs (AEDs), nearly 30% of patients remain refractory to treatment or experience intolerable side effects, such as cognitive impairment, hepatotoxicity, or sedation. These limitations have prompted interest in alternative therapies, especially those derived from medicinal plants. Herbal medicine, deeply rooted in traditional systems like Ayurveda, Unani, and Traditional Chinese Medicine, offers a wide array of plant-based compounds with neuroprotective and anticonvulsant potential. Numerous phytochemicals—such as alkaloids, flavonoids, terpenoids, and essential oils-have demonstrated anticonvulsant effects in preclinical models through mechanisms that involve modulation of gamma-aminobutyric acid (GABA) receptors, inhibition of excitatory neurotransmitters like glutamate, antioxidant action, and calcium channel blockade. Notable examples include Nigella sativa (black seed), Bacopa monnieri (brahmi), Withania somnifera (ashwagandha), Valeriana officinalis (valerian), and Passiflora incarnata (passionflower). These plants have shown efficacy in animal models such as pentylenetetrazol (PTZ)-induced seizures, maximal electroshock (MES), and kindling models. Among these, Nigella sativa and its key bioactive component thymoquinone have garnered particular attention for their ability to delay seizure onset and reduce seizure severity through GABAergic and antioxidant mechanisms. While early studies are promising, more rigorous clinical trials are needed to validate their safety, efficacy, and potential for integration into modern antiepileptic regimens [9-11].

TYPES OF EPILEPSY

Epilepsy is a chronic neurological disorder characterized by recurrent, unprovoked seizures, and it manifests in several distinct types based on the origin, nature, and symptoms of the

seizures. The two primary categories are focal epilepsy, where seizures originate in a specific area of the brain, and generalized epilepsy, where seizures begin simultaneously in both hemispheres. Focal seizures can be further divided into focal aware (simple partial), focal impaired awareness (complex partial), and focal to bilateral tonic-clonic seizures. Generalized seizures include various forms such as absence seizures (brief lapses in awareness), tonic-clonic seizures (muscle stiffening followed by jerking), myoclonic seizures (sudden muscle jerks), atonic seizures (loss of muscle tone), tonic seizures (stiffening), and clonic seizures (repetitive jerking). In some cases, individuals may experience both focal and generalized seizures, a condition known as combined generalized and focal epilepsy. When the seizure onset is unclear, the condition is classified under unknown onset epilepsy, pending further diagnosis. Additionally, specific epilepsy syndromes exist, often defined by age of onset, genetic background, and seizure type-examples include childhood absence epilepsy, juvenile myoclonic epilepsy, Lennox-Gastaut syndrome, Dravet syndrome, and West syndrome. The etiology of epilepsy can be classified as genetic, structural, metabolic, infectious, immune-related, or of unknown cause, highlighting the complex and multifactorial nature of the disorder. Understanding the different types of epilepsy is crucial for appropriate diagnosis, treatment, and management [12-14].

ETHIOLOGY OF EPILEPSY

Epilepsy can arise from a variety of causes, broadly categorized under genetic, structural, metabolic, infectious, immune, and unknown origins. Genetic epilepsy results from inherited or spontaneous mutations that affect neuronal excitability and synaptic function, often seen in syndromes like Dravet or juvenile myoclonic epilepsy. Structural causes involve brain abnormalities such as tumors, stroke, traumatic brain injury, or malformations of cortical development, which disrupt normal neural networks and provoke seizures. Metabolic epilepsies are linked to inborn errors of metabolism or systemic imbalances like hypoglycemia or electrolyte disturbances that impair brain function. Infections of the central nervous system—such as meningitis, encephalitis, or parasitic infections like neurocysticercosis—can cause infectious epilepsy by damaging neural tissue. Autoimmune mechanisms can also trigger seizures when the immune system attacks brain components, termed immune epilepsy. Despite advances in diagnostics, many cases remain of unknown etiology, where no clear cause is identified, underscoring the complex and multifactorial nature of epilepsy. Accurate identification of the underlying cause is essential for tailoring treatment and improving patient outcomes [15-16].

PATHOPHYSIOLOGY OF EPILEPSY

Epilepsy is fundamentally a disorder of neuronal excitability and synchronization, characterized by recurrent seizures caused by sudden, excessive electrical discharges in the brain. The pathophysiology of epilepsy is multifactorial and involves an imbalance between excitatory and inhibitory processes within neural networks. Under normal circumstances, the brain maintains a delicate equilibrium between excitatory neurotransmitters such as glutamate and inhibitory neurotransmitters like gamma-aminobutyric acid (GABA), which together regulate neuronal firing and prevent hyperexcitability. In epilepsy, this balance is disrupted by increased excitatory synaptic transmission, decreased inhibitory tone, or a combination of both, leading to a state of neuronal hyperexcitability. At the cellular level, dysfunctions in ion channels-such as voltage-gated sodium, potassium, and calcium channels—play a critical role by altering the action potential threshold, firing rate, and neurotransmitter release. For instance, mutations in genes encoding ion channel proteins (known as channelopathies) can enhance neuronal excitability and predispose individuals to seizures. Additionally, abnormalities in receptor function, including upregulation of excitatory glutamate receptors (NMDA and AMPA) and downregulation of inhibitory GABA_A receptors, contribute to the facilitation of seizure activity. Beyond neurotransmitter imbalance, structural brain abnormalities like cortical dysplasia, tumors, stroke-induced gliosis, and hippocampal sclerosis can create aberrant neuronal circuits that promote seizure generation and propagation. Neuroinflammation has also emerged as a significant contributor, where activation of microglia and astrocytes releases cytokines and other inflammatory mediators that alter neuronal excitability and blood-brain barrier integrity. Moreover, recurrent seizures themselves induce neuroplastic changes, such as synaptic reorganization, neurogenesis, and altered gene expression, which can exacerbate the epileptic condition-a process referred

to as electrogenesis. This creates a vicious cycle where the brain becomes increasingly susceptible to seizures over time. At the network level, hypersynchronous firing and abnormal connectivity facilitate the spread of epileptic discharges from a focal point to involve wider brain regions, manifesting clinically as different seizure types. Understanding the complex pathophysiology of epilepsy is crucial for developing targeted therapies aimed not only at suppressing seizures but also at modifying the disease process itself [15-18].

MATERIALS AND METHODS

COLLECTION AND IDENTIFICATION OF PLANT MATERIAL

The Tribulus terrestris is collected and identified. The leaves were collected from local areas of Tirupati and Authenticated by Dr. K. Madhava Chetty, Assistant professor, Department of Botany S.V University Tirupati. Andhra Pradesh.

Extraction of plant material

Abutilon indicum are collected and shade dried for one week, the dried leaves are pulverized by a mechanical grinder reduced to coarse powder and around 60g of powder material was subjected to successively hot continuous extraction .a weight quantity of each of the plant powdered material was extracted by Soxhlet with ethanol of 250ml for 24hrs with intermediate heating at 40 0 c after that the residues were extracted the extract was filtered using Whatmann filter paper and then the extract was evaporated in a rota evaporator and further dried under vacuum.

Experimental Animals

Healthy adult Wistar albino rats of either sex weighing about 150–200 g were procured from a registered animal house approved by the Committee for the Purpose of Control and Supervision of Experiments on Animals. The animals were housed in clean polypropylene cages containing sterile paddy husk bedding under standard laboratory conditions. The animal room was maintained at a controlled temperature of 25 ± 2°C with relative humidity of 55 ± 5% and a 12-hour light/dark cycle. The animals were fed with standard pellet diet and provided with clean drinking water ad libitum throughout the experimental period. Before the initiation of the study, the animals were acclimatized to laboratory conditions for a period of 7 days. Proper hygienic conditions were maintained by regular cleaning of cages and replacement of bedding materials. All experimental procedures involving animals were carried out in accordance with CPCSEA guidelines and institutional ethical committee regulations.

Acute Toxicity Studies

Acute toxicity studies for the ethanolic extract of Abutilon indicum leaves were carried out according to the guidelines of the Organization for Economic Co-operation and Development guideline No. 423 (Acute Oral Toxic Class Method). Healthy adult Wistar albino rats or Swiss albino mice of either sex weighing about 20–30 g were used for the study. The animals were housed under standard laboratory conditions with controlled temperature (25 ± 2°C), relative humidity (55 ± 5%), and a 12 h light/dark cycle. They were provided with standard pellet diet and water ad libitum. Before administration of the extract, animals were fasted overnight with free access to water. The extract of Abutilon indicum was administered orally at different dose levels such as 300 mg/kg and 2000 mg/kg body weight. After administration, the animals were continuously observed for the first 4 hours for behavioral, neurological, and autonomic changes such as alertness, tremors, convulsions, salivation, lacrimation, diarrhea, lethargy, sleep, and coma. Further observations were made periodically for 24 hours and daily for 14 days to identify any signs of toxicity or mortality. No mortality or significant toxic symptoms were observed in the treated animals up to the dose of 2000 mg/kg body weight, indicating that the extract was found to be safe and well tolerated. Based on the results of the acute toxicity study, experimental doses such as 200 mg/kg and 400 mg/kg body weight were selected for evaluating the antiepileptic activity of the extract [19].

Animal grouping [20]

Group I	Normal Control Normal saline (1 ml/kg, p.o.)
Group II	Negative control Epileptic inducer only
Group III	Standard treatment Standard antiepileptic drug Diazepam
Group IV	Low dose Ethanolic extract of Abutilon indicum (200 mg/kg, p.o.)
Group V	High dose Ethanolic extract of Abutilon indicum (400 mg/kg, p.o.)

Induction of Seizures by MES Method [21]

Seizures were induced in Wistar albino rats using the Maximal Electroshock Seizure (MES) method. In this method, electroconvulsive shock was delivered through corneal electrodes using an electroconvulsiometer. Prior to the application of electrical stimulus, a drop of normal saline was applied to the corneal surface to ensure proper electrical contact and minimize corneal injury. A current strength of 150 mA was applied for 0.2 seconds to induce convulsions. The animals were observed carefully for different phases of seizures, particularly hind limb tonic extension (HLTE), duration of convulsions, recovery time, and mortality. Abolition or reduction in the duration of HLTE was considered as a protective effect against seizures and indicated antiepileptic activity of the test extract. The ethanolic extract of Abutilon indicum and the standard antiepileptic drug were administered orally 60 minutes before seizure induction.

Determination of Parameters

Open Field Test (OFT) [22]

The Open Field Test (OFT) was carried out to assess locomotor activity, exploratory behavior, and anxiety levels in rodents. The apparatus consisted of a square arena with the floor divided into equal squares, and the central region was defined for evaluation of anxiety-related behavior. Each animal was placed individually in the Centre of the open field and observed for 5–10 minutes. The parameters recorded included the number of squares crossed (ambulation), frequency of rearing on hind limbs, grooming episodes, defecation, and the time spent in the central versus peripheral zones. Increased locomotor activity and rearing were considered indicators of heightened exploratory behavior, while reduced central zone entries and increased grooming or defecation were associated with anxiety and stress. After each trial, the arena was cleaned with 70% ethanol to eliminate olfactory cues.

Rotarod test [23]

The Rotarod test was used to assess motor coordination, balance and motor learning in rodents. Mice were first habituated to the apparatus on a training day (3 familiarization trials at a constant low speed of 4–8 rpm, 60–120 s each, with 15 min inter-trial intervals); animals failing to stay on for at least one training trial are excluded. On the test day, each animal was placed on the rotating rod and the device was run in accelerating mode from 4 rpm to 40 rpm over 300 s (5 min); latency to fall (s) was recorded for each mouse. Three test trials per animal were performed with an inter-trial interval of 15 min and the mean latency to fall used for analysis. A cut-off time of 300 s was applied to avoid fatigue-related injury. Animals receive treatments (vehicle, standard drug or test extract) according to the experimental schedule with the final dose given ~60 min before the first trial. Between animals the rod and platform are wiped with 70% ethanol to remove olfactory cues. Data are expressed as mean ± SEM and analyzed by one-way ANOVA followed by appropriate post hoc tests; a reduction in latency to fall indicates impaired motor coordination or sedative/muscle-relaxant effects while no change (or improvement) suggests preserved motor function.

Biochemical parameters

Malondialdehyde (MDA) – lipid peroxidation [24]

The level of lipid peroxidation was estimated by measuring malondialdehyde (MDA), a stable end product of lipid peroxidation, using the Thio barbituric acid reactive substances (TBARS) assay. Briefly, tissue homogenates were prepared in ice-cold phosphate buffer (pH 7.4) and treated with 10% trichloroacetic acid (TCA) to precipitate proteins. The mixture was centrifuged, and the supernatant obtained was incubated with 0.67% Thio barbituric acid (TBA) solution in a boiling water bath at 95 °C for 15–30 minutes, leading to the formation of a pink chromogen due to the MDA–TBA adduct. After cooling, the absorbance of the mixture was measured at 532 nm against an appropriate blank. The concentration of MDA was calculated using the molar extinction coefficient (1.56×10^5 M^{-1} cm^{-1}), and results were expressed as nmol MDA per mg protein.

Superoxide dismutase (SOD) activity [25]

The Superoxide Dismutase (SOD) activity was measured spectrophotometrically using the pyrogallol autoxidation method. Briefly, tissue homogenates were prepared in ice-cold 50 mM Tris–HCl buffer (pH 7.8) containing 1 mM EDTA and centrifuged; the supernatant was used for the assay. The reaction mixture (final volume 3 mL) contained 50 mM Tris–HCl (pH 8.2), 1 mM EDTA and supernatant; pyrogallol (0.2 mM) was added to initiate autoxidation and the increase in absorbance at 420 nm was recorded every 30 s for 3–5 min at 25 °C. SOD activity was calculated from the degree of inhibition of pyrogallol autoxidation by the sample compared

with a control (reaction without sample) and expressed as U/mg protein (one unit = amount of enzyme causing 50% inhibition of pyrogallol autoxidation under the assay conditions). All assays were performed in triplicate and protein content was determined by the Bradford method for normalization.

Catalase (CAT) activity [26]

The Catalase (CAT) activity was determined by measuring the rate of decomposition of hydrogen peroxide (H_2O_2) spectrophotometrically. Tissue homogenates were prepared in ice-cold phosphate buffer (50 mM, pH 7.0) and centrifuged to obtain the supernatant. The reaction mixture consisted of phosphate buffer (pH 7.0), freshly prepared 30 mM H_2O_2 solution, and the enzyme extract. The decrease in absorbance due to H_2O_2 decomposition was recorded at 240 nm for 1–3 minutes at 25 °C using a UV–visible spectrophotometer. Catalase activity was expressed as U/mg protein, where one unit (U) is defined as the amount of enzyme required to decompose 1 µmol of H_2O_2 per minute under assay conditions. Protein content in the homogenates was determined by the Lowry or Bradford method for normalization.

Glutathione (GSH) levels [27]

The Reduced Glutathione (GSH) levels were estimated using the Ellman's reagent (5,5′-dithiobis-(2-nitrobenzoic acid), DTNB) method. Briefly, tissue homogenates were prepared in 0.1 M phosphate buffer (pH 7.4) and mixed with an equal volume of 10% trichloroacetic acid (TCA) to precipitate proteins. The samples were centrifuged, and the supernatant was collected. To this, 2 mL of 0.3 M disodium hydrogen phosphate buffer (pH 8.0) and 0.5 mL of Ellman's reagent (0.001 M DTNB prepared in 1% sodium citrate) were added. The yellow-colored chromogen formed due to the reaction of free sulfhydryl groups of GSH with DTNB was measured spectrophotometrically at 412 nm. The concentration of reduced GSH was calculated using a standard calibration curve and expressed as µmol GSH per mg protein.

RESULTS

Percentage of yield

$$Percentage\ of\ yield = \frac{Weight\ of\ crude\ extract}{Weight\ of\ dried\ material} \times 100$$

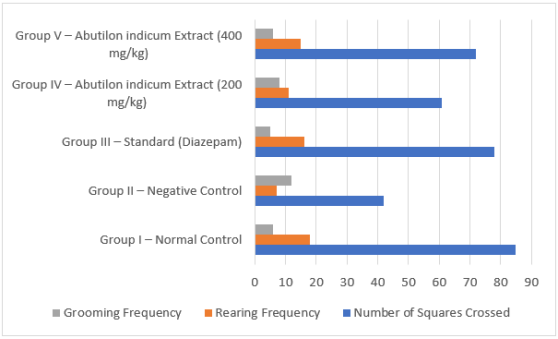
$$Percentage\ of\ yield = \frac{25g}{200g} \times 100 = 12.5\%$$

50gms of drug dissolved in 200ml of solvent in 1:4 Ratio

Open Field Test

Group	Number of Squares Crossed	Rearing Frequency	Grooming Frequency
Group I – Normal Control	85 ± 3.12	18 ± 1.24	6 ± 0.58
Group II – Negative Control	42 ± 2.45	7 ± 0.82	12 ± 0.76
Group III – Standard (Diazepam)	78 ± 2.86**	16 ± 1.05**	5 ± 0.42**
Group IV – Abutilon indicum Extract (200 mg/kg)	61 ± 2.34*	11 ± 0.96*	8 ± 0.63*
Group V – Abutilon indicum Extract (400 mg/kg)	72 ± 2.68**	15 ± 1.12**	6 ± 0.51**

The negative control group showed a significant reduction in locomotor and exploratory activity when compared with the normal control group. Treatment with the ethanolic extract of Abutilon indicum produced a dose-dependent increase in the number of squares crossed and rearing frequency, along with reduction in grooming behavior. The higher dose (400 mg/kg) exhibited significant improvement, comparable to the standard drug Diazepam, indicating potential central nervous system protective and antiepileptic activity.

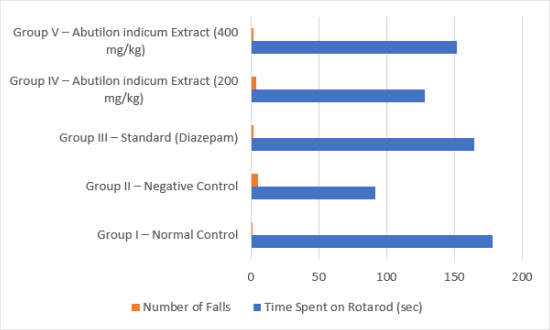


Rotarod test

Group	Time Spent on Rotarod (sec)	Number of Falls
Group I – Normal Control	178 ± 4.26	1 ± 0.21
Group II – Negative Control	92 ± 3.14	5 ± 0.42
Group III – Standard (Diazepam)	165 ± 3.86**	2 ± 0.30**
Group IV – Abutilon indicum Extract (200 mg/kg)	128 ± 3.45*	4 ± 0.36*
Group V – Abutilon indicum Extract (400 mg/kg)	152 ± 3.72**	2 ± 0.28**

The negative control group showed a marked decrease in the time spent on the rotating rod along with an increased number of falls, indicating impairment of motor coordination due to seizure induction. Treatment with the ethanolic extract of Abutilon indicum significantly improved motor coordination and balance in a dose-dependent manner. The higher dose (400 mg/kg) showed results comparable to the standard drug

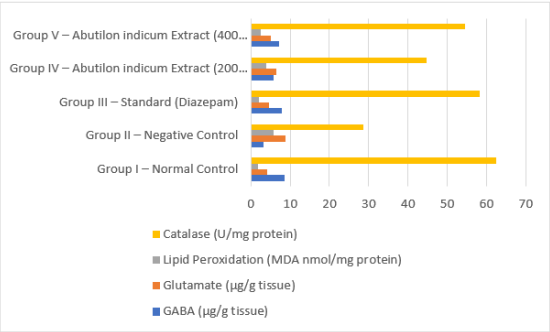
Diazepam, suggesting protective effects on neuromuscular coordination and central nervous system function.



Biochemical Parameters

Group	Group I – Normal Control	Group II – Negative Control	Group III – Standard (Diazepam)	Group IV – Abutilon indicum Extract (200 mg/kg)	Group V – Abutilon indicum Extract (400 mg/kg)
GABA (µg/g tissue)	8.62 ± 0.24	3.14 ± 0.18	7.94 ± 0.21**	5.68 ± 0.19*	7.12 ± 0.22**
Glutamate (µg/g tissue)	4.18 ± 0.16	8.86 ± 0.22	4.52 ± 0.18**	6.42 ± 0.20*	5.06 ± 0.17**
Lipid Peroxidation (MDA nmol/mg protein)	1.92 ± 0.08	5.74 ± 0.16	2.14 ± 0.10**	3.84 ± 0.14*	2.46 ± 0.11**
Catalase (U/mg protein)	62.4 ± 2.14	28.6 ± 1.42	58.2 ± 1.96**	44.8 ± 1.68*	54.6 ± 1.84**

The negative control group exhibited a significant decrease in gamma aminobutyric acid (GABA) and catalase levels, along with elevated glutamate and lipid peroxidation levels, indicating seizure-induced oxidative stress and neuronal excitation. Treatment with the ethanolic extract of Abutilon indicum produced a dose-dependent restoration of biochemical parameters. The higher dose (400 mg/kg) significantly increased GABA and antioxidant enzyme levels while reducing glutamate and lipid peroxidation, showing marked neuroprotective and antiepileptic activity comparable to the standard drug Diazepam.



DISCUSSION

The present study was carried out to evaluate the antiepileptic activity of the ethanolic extract of Abutilon indicum using experimental animal models. Epilepsy is a chronic neurological disorder characterized by recurrent seizures resulting from excessive neuronal discharge in the brain. The Maximal Electroshock Seizure (MES) model is widely employed for screening antiepileptic agents effective against generalized tonic-clonic seizures. Acute toxicity studies revealed that the ethanolic extract of Abutilon indicum was safe up to a dose of 2000 mg/kg body weight, indicating a wide margin of safety. Based on these findings, doses of 200 mg/kg and 400 mg/kg were selected for pharmacological evaluation. In the Open Field Test, the negative control group showed reduced locomotor and exploratory activity, indicating seizure-induced behavioral alterations and anxiety-like symptoms. Treatment with the extract significantly improved locomotor activity, rearing response, and grooming behavior in a dose-dependent manner. The higher dose (400 mg/kg) produced results comparable to the standard drug Diazepam, suggesting central nervous system stabilizing activity. The Rotarod test demonstrated marked impairment of motor coordination in the negative control animals. Administration of the ethanolic extract significantly increased the time spent on the rotating rod and reduced the number of falls, indicating improvement in muscle coordination and neuromuscular function. The observed effect may be attributed to the neuroprotective constituents present in the plant extract. Biochemical estimation revealed a significant decrease in GABA and catalase levels along with increased glutamate and lipid peroxidation levels in the negative control group, confirming seizure-induced oxidative stress and neuronal hyperexcitability. Treatment with the ethanolic extract restored these altered biochemical parameters toward normal values. Increased GABA levels indicate enhancement of inhibitory neurotransmission, while reduction in glutamate levels suggests suppression of excitatory neuronal activity. Decreased lipid peroxidation and elevated catalase activity further demonstrate the antioxidant potential of the extract. The antiepileptic activity of Abutilon indicum may be attributed to the presence of phytoconstituents such as flavonoids, alkaloids, phenolic compounds, glycosides, and tannins, which are known to possess neuroprotective and antioxidant properties. These phytochemicals may act synergistically to reduce seizure activity and protect neuronal cells from oxidative damage. present investigation suggests that

the ethanolic extract of Abutilon indicum possesses significant antiepileptic activity and could serve as a potential natural therapeutic agent for the management of epilepsy.

Conclusion

The present study demonstrated that the ethanolic extract of Abutilon indicum possesses significant antiepileptic activity in experimental animal models. Acute toxicity studies confirmed that the extract was safe up to 2000 mg/kg body weight, indicating a wide safety margin. The extract showed marked improvement in behavioral and motor coordination parameters in the Open Field and Rotarod tests. Biochemical investigations revealed that the extract significantly increased GABA and antioxidant enzyme levels while decreasing glutamate concentration and lipid peroxidation, thereby reducing neuronal excitability and oxidative stress associated with seizures. The higher dose (400 mg/kg) exhibited better protective effects and showed activity comparable to the standard antiepileptic drug Diazepam. The observed pharmacological activity may be attributed to the presence of bioactive phytoconstituents such as flavonoids, alkaloids, phenolics, tannins, and glycosides present in the plant extract. Overall, the findings suggest that Abutilon indicum has promising neuroprotective and antiepileptic potential and may serve as a valuable source for the development of safer herbal anticonvulsant agents.

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