European Journal of Clinical Pharmacy
Print ISSN: 2385-409X **Online ISSN**: Applied Website:
https://farmclin.com/

Anti-Epileptic Screening of Hydroalcoholic Extract of Ipomoea eriocarpa: Preclinical Evaluation in Experimental Models

Komal Manwani[1]*, Mayur Porwal[2]
[1*] Research Scholar, Department of Pharmacology, Teerthanker Mahaveer College of Pharmacy, Teerthanker Mahaveer University, Moradabad, UP, India, 244001
[2] Department of Pharmacology, Teerthanker Mahaveer College of Pharmacy, Teerthanker Mahaveer University, Moradabad, UP, India, 244001
***Corresponding author** E-mail: komalmanwani17@gmail.com

ABSTRACT

Epilepsy is a persistent neurodegenerative illness characterized by frequent episodes of seizures, and modern antiepileptic pharmacologic treatment tends to be comparatively unproductive with unsavoury side effects. This study was aimed at evaluating the antiepileptic effects of a bioactive-guided fraction of the hydroalcoholic extract of Ipomoea eriocarpa (HEIE) in three classical convulsions models maximal electroshock (MES), pentylenetetrazol (PTZ) and isoniazid (INH) in adult Wistar rats. HEIE with 20 and 40 mg/kg and diazepam (5 mg/kg) as standard was administered on the subjects In the MES paradigm, HEIE resulted in the dose depending reduction of duration of flexion, extensor, clonic and stupor phases, which culminated in full prevention of mortality. The extract notably postponed the epileptic attacks, reduced the time span of the clonic activity and at the dosage of 40 mg kg-1 offered the same protection as Diazepam. Equally, in the INH model, HEIE significantly delayed the onset of seizure, shortened convulsive, and guaranteed complete survival in the two investigated doses. Histopathological study showed that the treatment of HEIE preserved the hippocampal and cortical neurons architecture in the groups which was more significant at higher dosage. These observations imply that Ipomoea eriocarpa has great anticonvulsant and neuroprotective effects, which is likely to occur via the mechanisms of GABAergic neurotransmission regulation and voltage-dependent ion channels. The available information offers scientific support to the conventional therapeutic uses of this species and develops the potential that it could have as natural pharmacotherapeutic agent to treat epilepsy.

KEYWORDS: Epilepsy, Histopathology, Ipomoea eriocarpa, Isoniazid-induced convulsion model, Maximal electroshock seizure model (MES), Pentylenetetrazol (PTZ) Model

How to Cite: Komal Manwani, Mayur Porwal, (2025) Anti-Epileptic Screening of Hydroalcoholic Extract of Ipomoea eriocarpa: Preclinical Evaluation in Experimental Models, European Journal of Clinical Pharmacy, Vol.7, No.1, pp. 5147-5156

INTRODUCTION

Epilepsy is the fourth most prevalent brain disease, manifested by recurrent seizures. It affects people irrespective of age. A variety of etiologies and injuries are linked to epileptic seizures, with differing distribution in the world [1] . Epilepsy was defined by the ILAE in the year 2014 as a “disease” and not a “disorder” [2]. The term “disease” better emphasizes to patients, clinicians, and society the importance and impact of epilepsy. The International League against Epilepsy (ILAE) and the International Bureau for Epilepsy (IBE) (2017) define epilepsy as a malfunction of the brain at the neurobiological, neurocognitive, neuropsychological, and neurosocial levels, as well as the neurobiological, cognitive, psychological, social cost of epilepsy. [3] . In terms of mechanism, an epileptic seizure can be defined as “a state produced by an abnormal excessive neuronal discharge within the central nervous system”. It is frequently related to cognitive and memory deficits, causing significant morbidity [4].

Epilepsy syndromes that are rare and those whose process of inheritance is onogenic are linked to defects in the genes that encode subunits of voltage-gated ion channels and ligand-gated ion channels. Na+, K+, and Cl- mutation in voltage-gated ion channels have been linked to varieties of generalized epilepsy and infantile seizure syndromes [5]. The causes of secondary epilepsy include infections, inflammation, neurodegenerative diseases, brain tumors, traumatic brain crimes, stroke, as well as congenital disorders [6]. The typical signs and/or symptoms of abnormal neuronal activity, which include excessive or synchronous activity in the brain are linked to seizures [7]. The epileptic seizures often result in a momentary loss of consciousness, expose the affected patient to the danger of physical injuries, and usually disrupt learning and working. Epilepsy may happen more often in young children or any person over 65 years of age but at any age. The identified pathogeneses of epilepsy are now reclassified as hereditary, structural, infectious, immunological, metabolic, or unknown [8]. Moreover, epilepsy is proclaimed as a disease not as a disorder. It is reportedly solved after a period of ten years of the seizure-free interval, the final five years being medication-free, or the patient is not under threat anymore due to his age as of age related epilepsy syndrome [9].

Epilepsy is more common in the youngest and the oldest age-groups [10] with the estimated rates standing at 86 per 100,000 per year in a well defined population in the first year of life, decreasing afterwards to the range of 2331 per 100,000 in individuals aged 3059 years [11] and the lowest rates are recorded at the over 85 years of age. The highest rates of epilepsy

occur during the first year of life in children and the level drops up to the age of 10 years[12]. The comparatively high incidence of epilepsy among the aged has been realized. This significant problem was brought to attention through national Sentinel Audit of epilepsy-related deaths with the leadership of Bereaved epilepsy. The check indicated that, 1,000 people die annually in the UK as a result of epilepsy, and the majority of them were related to seizures and 42 percent of the deaths were preventable [13].

Research has indicated that most epileptic patients are not taking ASMs mostly because of the lack of access to a physician, cost of ASM, and perception of modern therapies. A less extreme practical strategy would be to make use of natural products or extracts that have been traditional in being known to be useful in the anti-seizure activity. This facilitates the interest to explore the possible benefit of compounds or extracts of plants which can be used medically to treat seizure, but the effect of these treatment methods is not well understood. Only 2 per cent to 44 per cent of these patients used these products particularly in the management of seizures; the rest were, and others used them in managing known comorbidities that were associated with epilepsy, such as depression, or to treat well-known ASM side effects, including impaired memory [14].

More than 135 varieties of herbs have been reported to be used alone or as a part of an 80 different combinations in the treatment of seizures [15]. The utilization of medicinal products as a healthcare modality has risen [16]. In developing nations, traditional herbal treatments are a culturally significant approach to healing therapies. These remedies are effective, widely accepted, economically feasible, and often the only available option, making them economically viable [17]. Traditional plant-based medicines are crucial for global health and disease management, extensively utilized in Africa and Asia, particularly in India and China. Due to adverse reactions and resistance to synthetic medications, they are gaining popularity in developed nations [18]. Recent research has revealed that several therapeutic herbs also have adverse consequences [19]. Prolonged use of therapeutic herbs raises concerns about potential harmful effects. Assessing the toxicological consequences of therapeutic plant extracts is crucial for evaluating potential harmful effects.

Ipomoea eriocarpa, popularly referred to as "tiny morning glory", is located in tropical Asia, northern Australia, Madagascar, South Africa, Egypt, and various regions of tropical Africa and southern India [20] . Approximately 8,000 polyphenolic substances were effectively discovered among different species of plants. [21]. The traditional uses of *I.eriocarpa* (methanolic and petroleum ether extract) includes migraines, joint inflammation, seizures, open sores, and high fever [22]. The preclinical study of *I. eriocarpa* has recently verified defensive properties on brain. [23], antioxidant abilities [24], prevention of secretions [25], analgesics [26], antipyretic [27], activity contrary to worms [28], antimicrobial properties [28], also aids from arthritis, diabetes, as well as kidney stones preclusion [28,29].

According to Dr. C. P. Khare's “The Indian Medicinal Plants”, it has been reported that *I.eriocarpa* has antiepileptic properties. According to a phytochemical investigation, the plant's (methanolic extract) contains phenols, flavonoids, phytosterols, and alkaloids [29,30], which are essential to treat epilepsy. However, no systematic research has been conducted on its antiepileptic properties to date. Therefore, in the current study, we evaluated the antiepileptic activity of ethyl acetate residual fraction of hydroalcoholic extract of *Ipomoea eriocarpa* (HEIE) as an adjuvant to the maximal electroshock seizure model (MES), Pentylenetetrazol (PTZ) Model, and Isoniazid-induced convulsion model of acute seizure.

MATERIAL AND METHODS

Collection and authentication of the plant

Fully grown plant specimens of *I. eriocarpa* were gathered from Barkagao, Hazaribag District, Jharkhand, India (23° 85' 31.10" N latitude, 85° 20' 58.51" E longitude, and 610 m altitude). The voucher specimen (KM81123) was prepared, presented, and authenticated by Dr. P. Santhan, a botanist and taxonomist from Jharkhand.

Preparation of plant extract

The entire extraneous substance was meticulously evacuated from the *I. eriocarpa* plant matter following a thorough cleansing process. After undergoing a clean water wash and being dried under shade for three to four weeks, the plant material was roughly grounded with the help of a motorized blender. The grounded stuff was securely kept in desiccated, disinfected baggage. Approximately 25 grams of powdered material underwent defatting with petroleum ether at a temperature range of 40°C to 60°C. Following the defatting process, the grounded material was utilized for extraction with hydroalcoholic in a ratio of 3:7 for about a day [31]. The extract was kept at the surrounding climate for parching, also the concentrated extract was employed for the isolation procedure to conduct *in vivo* screening models for antiepileptic activity of *I.eriocarpa* [32].

Bioactive guided fractionation

Ethyl acetate fraction

Water was used to dissolve the necessary amount of polar extract. Double the volume of ethyl acetate was incorporated into the dissolved extract. The elements dissolved in ethyl acetate were isolated by gently shaking the mixture. The ethyl acetate portion was subsequently filtered and dried by evaporation [33].

Residual fraction (Final fraction)

The remaining residue following the fractionation process, utilizing ethyl acetate, underwent filtration and was subsequently evaporated to dryness [33]. The formula utilized to determine the residual fraction yield % was as follows:

$$Yield\ \% = \frac{Weight\ of\ solvent\ free\ extract\ (g)}{Dried\ extract\ weight} \times 100$$

Drugs

Isoniazid and pentylenetetrazole (PTZ) were both purchased from Sigma-ALDRICH (India). Both the drug solutions were freshly prepared by dissolving in saline, and the solvents used were of analytical grade.

Experimental animals

The acute and subacute toxicological experiments were carried out in only healthy male and female albino Wistar rats aged 6–8 weeks, weighing 130–180 g, and free from visible signs of illness or abnormality were included. Animals exhibiting signs of infection, congenital anomalies, or abnormal behavior during the acclimatization period were excluded from the study. Rats were randomly assigned to groups using a simple randomization method to avoid bias. The rats were attained from the animal facility at TMU, Moradabad, India, and were familiarized with laboratory environments for seven days before the experimentations [34] . The rats were kept at a controlled room temperature of 22-24^{o}C, with a 12-hour light/dark phase and moisture of approximately 50±5%. They were randomly assigned to experimental or control groups also were independently accommodated in disinfected polypropylene cages, utilizing sterilized padded husk as bedding material and were provided with a normal pellet supply and water as needed. The investigational techniques adhered to guidelines set by the "Institutional Animal Ethics Committee" (IAEC) and the "Committee for the Control and Supervision of Experiments on Animals" (CCSEA), accompanied by an approval number CCSEA/1205/2025/8.

The doses of 20 mg/kg and 40 mg/kg of the ethyl acetate residual fraction were chosen on the basis of previously conducted acute and sub-acute toxicity studies, principles of bioactivity-guided fractionation, and established pharmacological dosing practices. These doses represent safe sub-toxic levels, commonly selected as fractions of the maximum non-toxic dose to assess dose-dependent pharmacological effects."

Anti-epileptic Screening Methods

Maximal Electroshock (MES) Induced Convulsions:

The albino Wistar rats, weighing between 130 and 180 grams, were chosen at random and marked for identification purposes. They were subsequently organised into 4 distinct groups, each consisting of 6 animals. The negative control received distilled water (10mL/kg), while the standard group received diazepam at 5 mg/kg. The Test-I group received a bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* at a dosage of 20 mg/kg, and the Test-II group received the same fraction at 40 mg/kg. After half an hour, convulsions were elicited in all the rats through the application of an electroconvulsometer. An alternating current of 60 Hz and 150 mA was administered via the ear electrodes for a duration of 2 seconds (Table 1). The subjects were meticulously monitored for the manifestation of flexion, tonic hind limb extension, clonic activity, stupor, demise/recovery of the organism, and percentage of protection [35]

Table 1 Treatment Profile and Experimental Design Summary of Maximal Electroshock (MES) Induced Convulsions in Rats

Group	Group name	Dose & route of administration	Species& strain	Sex
Group 1	Negative Control	Distilled water (5 mL/kg) p.o. + MES	Albino Wistar Rat	Male
Group 2	Standard	Diazepam (5 mg/kg) p.o.+ MES		
Group 3	Test	MES+ The bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (20mg/kg) p.o.		
Group 4	Test	MES+ The bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (40mg/kg) p.o.		

Pentylenetetrazol (PTZ) Induced Convulsions in Rats

The animals, with weights ranging from 130 to 180 grams, were chosen at random and marked to facilitate their recognition. Subsequently, they were organized into 4 distinct groups, each one composed of six animals. The control group that was negative received water from distillation (5 ml/kg, per oral) alongside pentylenetetrazol (80 mg/kg, intraperitoneal). The standard group received diazepam (5 mg/kg, intraperitoneal) in conjunction with pentylenetetrazol (80 mg/kg, intraperitoneal). The Test-I group was given the bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (20 mg/kg, per oral) along with pentylenetetrazol (80 mg/kg, intraperitoneal), while the Test-II group received the bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (40 mg/kg, per oral) paired with pentylenetetrazol (80 mg/kg, intraperitoneal). The experimental pharmaceutical was administered continuously over a 7-day period. On the seventh day, convulsions were elicited through the administration of PTZ. All groups of animals were administered PTZ following the respective treatment before the commencement of the experiment (Table 2). The subjects were meticulously monitored for the emergence of jerks, initiation of clonic seizures, duration of clonic seizures, hind limb extension, mortality/recovery of the subjects, and percentage of protection [36].

Table 2 Treatment Profile and Experimental Design Summary of Pentylenetetrazol (PTZ) Induced Convulsions in Rats

Group	Group name	Dose & route of administration	Species& strain	Sex
Group 1	Negative	Distilled water (5 mL/kg) + PTZ (80 mg/kg, i.p.)		

	Control		Albino Wistar Rat	Male
Group 2	Standard	Diazepam (5 mg/kg) + PTZ (80 mg/kg, i.p.)		
Group 3	Test	The bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (20mg/kg) + PTZ (80 mg/kg, i.p.)		
Group 4	Test	The bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (40mg/kg) + PTZ (80 mg/kg, i.p.)		

Isoniazid-induced convulsion

Albino Wistar rats, weighing 130-180 grams, were selected and marked to facilitate their recognition. They were subsequently organized into four separate groups, each comprising 6 rats. Negative controls were administered with isoniazid (300 mg/kg, s.c.), with the injection occurring subcutaneously after a 60-minute interval following the vehicle. A dose of diazepam (5mg/kg, i.p.) as standard group was subsequently followed by the injection of isoniazid (300 mg/kg) via the subcutaneous route, administered 30 minutes after the initial dose. Test-I received the bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (20mg/kg) combined with isoniazid (300mg/kg) administered subcutaneously following a 60-minute interval post-test dose. In Test-II, a subcutaneous injection was administered comprising the bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* at a dosage of 40 mg/kg, alongside isoniazid at 300 mg/kg, precisely 60 minutes following the initial Test-II (Table 3). The subjects were meticulously monitored for the initiation of clonic seizures, the duration of convulsions, the eventual outcome of death or recovery, and the percentage of protection [37].

Table 3 Treatment Profile and Experimental Design Summary of Isoniazid-induced convulsion in Rats

Group	Group name	Dose & route of administration	Species & strain	Sex
Group 1	Negative Control	Distilled water (5 mL/kg) + isoniazid (300mg/kg, SC)	Albino Wistar Rat	Male
Group 2	Standard	Diazepam(5 mg/kg, i.p.)+isoniazid (300mg/kg, SC)		
Group 3	Test	The bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (20 mg/kg) +isoniazid (300mg/kg, SC)		
Group 4	Test	The bioactive guided fraction of the hydroalcoholic extract of *I.eriocarpa* (40 mg/kg) + isoniazid (300mg/kg, SC)		

Histopathology study

The brains of different group of rats were meticulously extracted and kept in a 10% buffered formalin fixation medium for histopathological analysis. The organ paraffin slices have been generated, stained with hematoxylin and eosin, and prepared for light microscopy according to established procedures. [38].

Statistical analysis

Each of the assessments was presented as the mean±SD standard deviation, and the outcomes were analyzed statistically using one-way Analysis of Variance (ANOVA) followed by Tukey's multiple comparison tests with statistical software called GraphPad Prism (GraphPad Software, Inc., La Jolla, CA, USA) version 5.0. A p-value of <0.05, $p<0.01$, and $p<0.001$ compared to the control was accepted as statistically significant.

RESULTS

Maximal Electroshock (MES) Induced Convulsions:

The antiepileptic effects of bioactive guided fractionation of HEIE were evaluated against a standard drug (diazepam) and compared to a negative control group on the maximal electroshock (MES) induced convulsion screening model. The negative control group exhibited severe seizure activity, characterized by prolonged durations of flexion (7.66 ± 1.75), extensor (15.16 ± 2.99), clonus (22.50 ± 3.27), and stupor (42.33 ± 3.50), resulting in 100% mortality (0% protection). In contrast, the standard group treated with diazepam showed a highly substantial ($p < 0.001$) decrease in all seizure stages, particularly complete suppression of the extensor phase (0.00 ± 0.00), with no deaths recorded (100% protection). Treatment with the bioactive guided fractionation of HEIE at two different doses produced a dose-related and substantial ($p < 0.001$) reduction in seizure activity. At the higher dose, the extract reduced flexion (2.16 ± 0.75) and extensor (2.33 ± 1.03), with complete protection against death (0/6). The lower dose also significantly reduced seizure parameters (flexion: 5.50 ± 1.87; extensor: 6.66 ± 1.75) and provided full protection. The bioactive guided fractionation of HEIE exhibited potent anticonvulsant activity in a dose-dependent manner, significantly reducing all phases of seizure activity and providing 100% protection from mortality, comparable to the standard drug diazepam (Table 4) (Figure 1).

Table 4 Antiepileptic Effect of Bioactive Guided Fractionation of Hydroalcoholic Extract of *I.eriocarpa* on the Maximal Electroshock (MES) Induced Convulsions in Rats

Experimental Groups	Flexion	Extensor	Clonus	Stupor	Death/ Recovery	% Protection
Negative Control	7.66 ± 1.75	15.16 ± 2.99	22.50 ± 3.27	42.33 ± 3.50	6/0	0%
Standard (Diazepam)	1.66 ± 0.81***	0.00 ± 0.00***	10.50 ± 1.87***	22.83 ± 3.76***	0/6	100%
bioactive guided fractionation of HEIE (20mg/kg)	5.50 ± 1.87***	6.66 ± 1.75***	17.83 ± 2.63***	31.33 ± 2.80***	0/6	100%
bioactive guided fractionation of HEIE (40mg/kg)	2.16 ± 0.75***	2.33 ± 1.03***	15.50 ± 2.58***	27.83 ± 2.31***	0/6	100%

The values are presented as the mean ± SD (n=6; male rats); p>0.05 was determined using one-way ANOVA followed by Tukey's multiple comparison test (in comparison to the control group); * $p<0.05$, ** $p<0.01$, and *** $p<0.001$

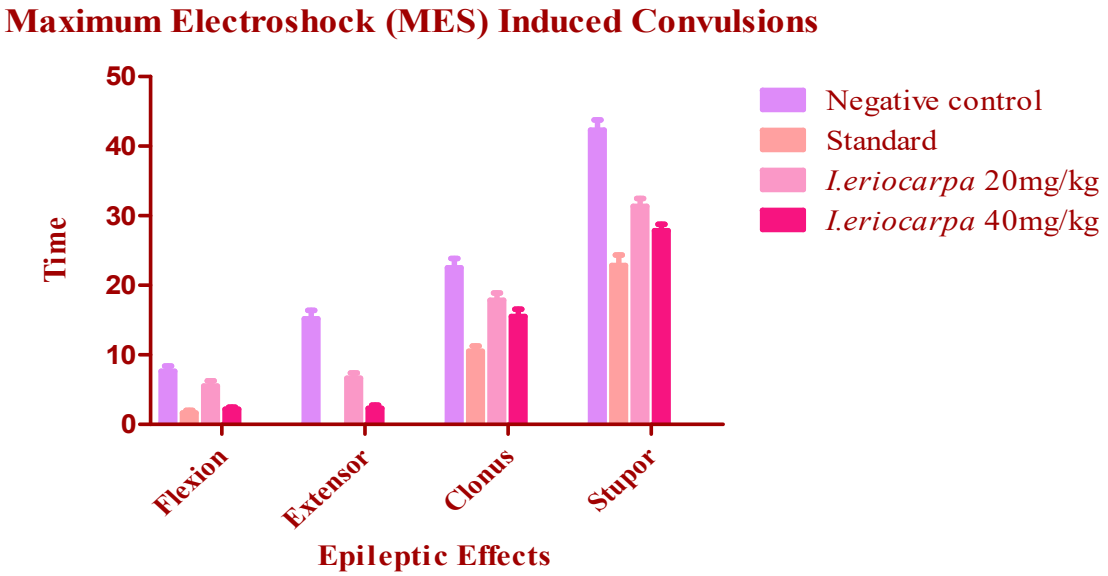

Figure 1 Antiepileptic Effect of Bioactive Guided Fractionation of Hydroalcoholic Extract of *I.eriocarpa* on the Maximal Electroshock (MES) Induced Convulsions in Rats

Pentylenetetrazol (PTZ) Induced Convulsions in Rats

The antiepileptic properties of bioactive guided fractionation of HEIE were evaluated against a standard drug (diazepam) and compared to a negative control group on the pentylenetetrazol (PTZ) induced convulsions screening model in rats using factors like the beginning of jerks, clonic, extension, duration of clonus, and mortality/protection rate. The negative control group displayed early seizure onset (jerks: 24.50 ± 3.61; clonus: 117.66 ± 2.33; extension: 146.83 ± 2.85), prolonged clonus duration (25.33 ± 2.58), and total mortality (6/0), indicating 0% protection. The diazepam-treated group showed complete suppression of seizures with all values at (0.00 ± 0.00) and 100% protection from mortality ($p < 0.001$), confirming its strong anticonvulsant activity. The bioactive guided fractionation of HEIE demonstrated a dose-dependent anticonvulsant effect. At the lower dose, onset of jerks and clonus was significantly delayed ($p < 0.01$) to 85.83 ± 4.16 and 167.16 ± 4.16, respectively. However, mild seizure activity remained (clonus duration: 20.50 ± 2.42), and 1 out of 6 animals died, resulting in 23% protection. At the higher dose, seizure onset was markedly delayed ($p < 0.001$) (jerks: 125.33 ± 2.80; clonus: 300.00 ± 2.60; extension: 322.50 ± 3.20), and clonus duration was reduced to 14.16 ± 2.63. This group showed complete survival (0/6 deaths), equating to 100% protection. The bioactive guided fractionation of HEIE effectively prolonged the beginning of seizure activity and reduced the severity of seizures that are dose-related, with the higher dose exhibiting protection equivalent to diazepam (Table 5) (Figure 2).

Table 5 Antiepileptic Effect of Bioactive Guided Fractionation of Hydroalcoholic Extract of *I.eriocarpa* on the Pentylenetetrazol (PTZ) Induced Convulsions in Rats

Experimental Groups	Onset of Jerks	Onset of Clonus	Duration of Clonus	Onset of Extension	Death/ Recovery	% Protection
Negative Control	24.50 ± 3.61	117.66 ± 2.33	25.33 ± 2.58	146.83 ± 2.85	6/0	0%

Standard (Diazepam)	0.00 ± 0.00***	0.00 ± 0.00***	0.00 ± 0.00***	0.00 ± 0.00***	0/6	100%
bioactive guided fractionation of HEIE (20mg/kg)	85.83 ± 4.16**	167.16 ± 4.16**	20.50 ± 2.42**	211.66 ± 3.88**	1/6	23%
bioactive guided fractionation of HEIE (40mg/kg)	125.33 ± 2.80***	300.00 ± 2.60***	14.16 ± 2.63***	322.50 ± 3.20***	0/6	100%

The values are presented as the mean ± SD (n=6; male rats); p>0.05 was determined using one-way ANOVA followed by Tukey's multiple comparison test (in comparison to the control group); * p<0.05, **p<0.01, and ***p<0.001

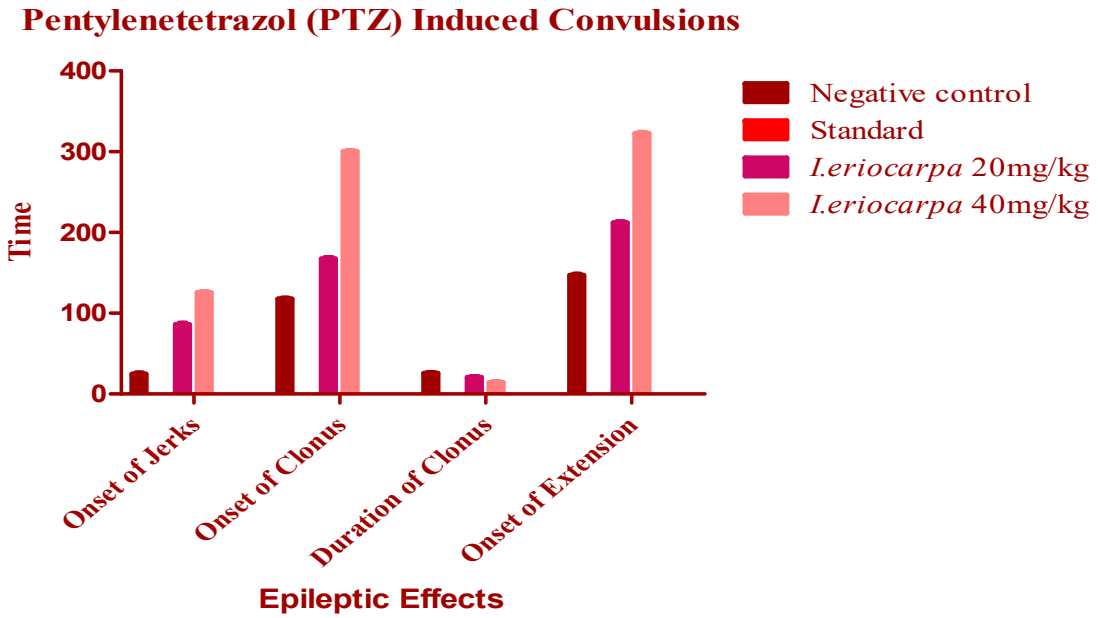

Figure 2 Antiepileptic Effect of Bioactive Guided Fractionation of Hydroalcoholic Extract of *I.eriocarpa* on the Pentylenetetrazol (PTZ) Induced Convulsions in Rats

Isoniazid-induced convulsion

The antiepileptic effects of bioactive guided fractionation of HEIE were evaluated against a standard drug (diazepam) and compared to a negative control group on the isoniazid-induced convulsions screening model in rats using clonic convulsion onset, duration, and survival rate as parameters. The negative control group exhibited an early onset of clonic convulsions (14.16 ± 2.63), prolonged convulsion duration (4.66 ± 1.63), and 100% mortality (6/0), resulting in 0% protection. The standard group treated with diazepam completely inhibited seizure onset and duration (0.00 ± 0.00) and provided 100% protection, confirming its strong anticonvulsant efficacy ($p < 0.001$). The bioactive guided fractionation of HEIE demonstrated a dose-dependent anticonvulsant effect. At 20 mg/kg, a substantial ($p < 0.001$) delay in the beginning of clonic convulsions (30.66 ± 2.58) and a mild ($p < 0.05$) reduction in convulsion duration (2.33 ± 0.51) were observed. All animals survived, indicating 100% protection. At 40 mg/kg, further delay in seizure onset (37.50 ± 1.87; $p < 0.001$) and a greater reduction in convulsion duration (1.66 ± 0.81; $p < 0.05$) were observed, with complete protection from mortality (0/6), confirming 100% protection. At both 20 and 40 mg/kg doses, the bioactive guided fractionation provided complete safety from seizure-induced death, comparable to the standard drug diazepam (Table 6) (Figure 3).

Table 6 Antiepileptic Effect of Bioactive Guided Fractionation of Hydroalcoholic Extract of *I.eriocarpa* on the Isoniazid-Induced Convulsions in Rats

Experimental Groups	Onset of Clonic Convulsion	Duration of Convulsion	Death/ Recovery	% Protection
Negative Control	14.16 ± 2.63	4.66 ± 1.63	6/0	0%
Standard (Diazepam)	0.00 ± 0.00***	0.00 ± 0.00***	0/6	100%
bioactive guided fractionation of HEIE (20mg/kg)	30.66 ± 2.58***	2.33 ± 0.51*	0/6	100%
bioactive guided fractionation of HEIE (40mg/kg)	37.50 ± 1.87***	1.66 ± 0.81*	0/6	100%

The values are presented as the mean ± SD (n=6; male rats); p>0.05 was determined using one-way ANOVA followed by Tukey's multiple comparison test (in comparison to the control group); * *p*<0.05, ***p*<0.01, and ****p*<0.001

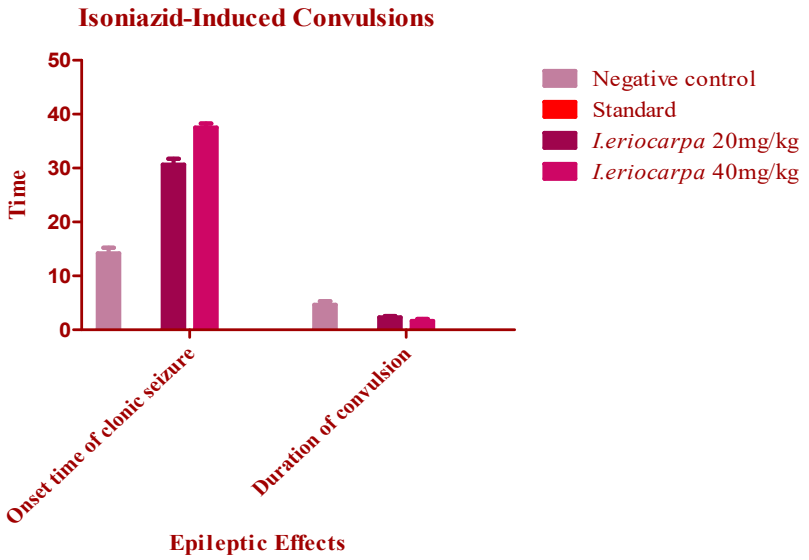

Figure 3 Antiepileptic Effect of Bioactive Guided Fractionation of Hydroalcoholic Extract of *I.eriocarpa* on the Isoniazid-Induced Convulsions in Rats

Histopathological of brain

Histopathology of the antiepileptic screening models of the brain were represented in Figure 4 where A,B,C,D are the histopathological slides of maximal electroshock (MES) induced convulsion screening model in rats, where A is the negative control representing the loss of neuronal architecture in the hippocampus and cortex, B is the standard diazepam (5 mg/kg) representing the normal structure of neurons, C is the bioactive guided fractionation of HEIE (20mg/kg) representing the slight loss of neuronal architecture in the hippocampus and cortex, D is the bioactive guided fractionation of HEIE (40mg/kg), representing the normal structure of neurons. E,F,G,H are the histopathological slides of pentylenetetrazol (PTZ) induced convulsions screening model in rats, where E is the negative control representing the shrunken, darkly stained (pyknotic) neurons, F is the standard diazepam (5 mg/kg) representing the normal structure of neurons, G is the bioactive guided fractionation of HEIE (20mg/kg) representing the slight shrunken, darkly stained (pyknotic) neurons, H is the bioactive guided fractionation of HEIE (40mg/kg), representing the normal structure of neurons. I,J,K,L are the histopathological slides of the isoniazid-induced convulsion screening model in rats, where I is the negative control representing the loss of neuronal architecture in the hippocampus and cortex, J is the standard diazepam (5 mg/kg) representing the normal structure of neurons, K is the bioactive guided fractionation of HEIE (20mg/kg) representing the slight loss of neuronal architecture in the hippocampus and cortex, L is the bioactive guided fractionation of HEIE (40mg/kg), representing the normal structure of neurons. Thus, the bioactive guided fractionation of HEIE (40mg/kg) proved to be the exhibiting protection equivalent to diazepam (Figure 4).

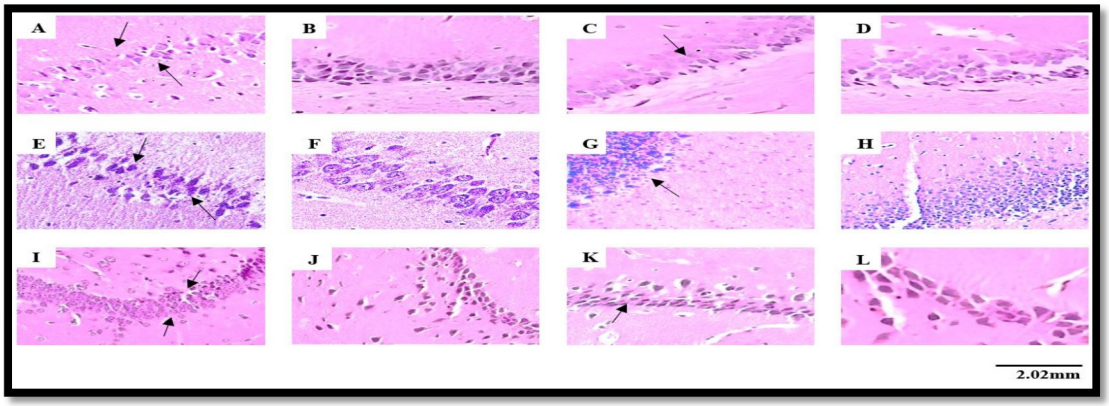

Figure 4 Histopathology of the Antiepileptic Screening Models of the Brain

DISCUSSION

Neurological disorder like epilepsy impacts a broad variety of individuals worldwide (65 million). It is a neurologist's second most prevalent chronic neurological disorder. India has approximately 10 million individuals with epilepsy. Epilepsy is an abnormal nervous transient dysfunction that affects motor, sensory, consciousness, and autonomic nervous system [39]. Studies have shown that the majority of patients with epilepsy are not treated with ASMs, largely due to a lack of access to physicians, the cost of ASMs, and attitudes toward modern treatments. An intermediate pragmatic approach is to utilize natural products or extracts traditionally known to be useful for anti-seizure activity. The utilization of medicinal products as a healthcare modality has risen [16] . In developing nations, traditional herbal treatments are a culturally significant approach to healing therapies. These remedies are effective, widely accepted, economically feasible, and often the only available option, making them

economically viable [17]. Traditional plant-based medicines are crucial for global health and disease management, extensively utilized in Africa and Asia, particularly in India and China. Due to adverse reactions and resistance to synthetic medications, they are gaining popularity in developed nations [18]. Over 135 different herbs have been reported to be used in a single or in 80 different combination formulae for the treatment of seizures [15].

According to Dr. C. P. Khare's "The Indian Medicinal Plants", it has been reported that *I.eriocarpa* has antiepileptic properties. According to a phytochemical investigation, the plant's (methanolic extract) contains phenols, flavonoids, phytosterols, and alkaloids [29,30], which are essential to treat epilepsy. As no investigation has been carried out for *I.eriocarpa* having anti-epileptic activity therefore, in the current study, we have investigated the anti-epileptic properties of *I.eriocarpa* as a novel anti-epileptic herbal medication in the treatment of epilepsy. The present study evaluated the antiepileptic potential of the bioactive-guided fraction of the hydroalcoholic extract of *Ipomoea eriocarpa* (HEIE) using three established experimental seizure models: MES, PTZ, and INH-induced convulsions.

During fractionation of the hydroalcoholic extract, the ethyl acetate residual fraction was enriched with moderately polar phytoconstituents, including flavonoids, phenolic compounds, and alkaloids-classes of compounds previously reported to possess anticonvulsant and neuroprotective activities.

MES model has been popularly employed to find the compounds which are active in the treatment of generalized tonic-clonic seizures, as well as agents that prevent the spread of the seizure, mostly by altering the activity of the voltage -gated sodium channels or the transmission via the glutamate category. This was the case in the negative control group in which classical tonic hind limb extension was observed with 100% mortality rate, which demonstrates that successful induction of seizures occurred. The HEIE treatment had a significant dose dependency of the reduction of all phases of the seizures (flexion, extensor, clonus and stupor). It is important to note that the 40mg/kg dose significantly reduced the extensor phase and offered 100 percent protection similar with diazepam. Repressed tonic hind limb extension indicates that Seizure propagation may be inhibited, perhaps by ion channel modulation [12]

Screening of agents that operate via GABAergic pathways is generally conducted via the PTZ model, since PTZ causes seizures due to its antagonism of the GABAA receptors. HEIE was found to be too effective in postponing the development of jerks, clonus, and extension and also minimizing the length of the clonic seizure. The greater dose (40 mg/kg) resulted in total failure of mortality whereas the lesser dose showed partial failure. The capability of HEIE to reduce the occurrence of seizure and severity implies an improvement in inhibitive neurotransmission, which could be facilitation of GABAergic transmission or control of conductance of chloride ion [13]

A GABA-mediated mechanism is also supported by the isoniazid (INH) model. INH causes seizures by blocking the production of glutamic acid decarboxylase, thus decreasing the production of GABA. HEIE produced significant extension of seizure onset, as well as a decrease in the duration of convulsions in a dose-dependent fashion, and 100 percent survivability in both dosage studies. The results provided in these studies support the assumption that the extract could increase the levels of GABA or reverse the impact of GABA decline.[15]

Morphological evidence of neuroprotection was given by histopathological examination. The negative control groups exhibited the neuronal degeneration, pykotonic nuclei, and distortion of hippocampal and cortical structures. However, contrary to that, animals which got HEIE, especially 40 mg/kg, displayed the intact neuronal morphology equal to the control drug group. This is an indication that in addition to suppressing seizure, the HEIE can have some protective effects against neuronal damage caused by seizure which could work through the antioxidant and anti-inflammatory effects that have been reported in the past [17]

The overall outcome of the extract was that it was found to be effective in electrically and chemically induced convulsive models implying that the activity has an extensive range of anticonvulsant effects. The dose dependence of the response also enhances the pharmacological significance of results. Limitations, however, are that there were no molecular mechanistic experiments, receptor binding experiments, and the purification of specific active compounds. Subsequent studies ought to concentrate on mechanistic evaluation in great detail, isolate of bioactive compounds, chronic models of epilepsy and safety profiling.

CONCLUSION

Epilepsy is also a significant worldwide neurological condition that is thought to impact about 65 million people around the world with a massive prevalence rate spread across the developing states like India. Access constraints to current antiepileptic medications, high cost of treatment, and social cultural restrictions have motivated the increased popularity and enthusiasm in traditional and plant-based medicines. One of them is *Ipomoea eriocarpa* (I. eriocarpa), which has traditionally been considered to possess medicinal research, but previously its antiepileptic capabilities had not been assessed by researchers. The current research paper is the first scientific validation of the antiepileptic effect of the bioactive-guided fraction of Hydroalcoholic extract of *Ipomoea eriocarpa*. The extract exhibited strong dose dependent anticonvulsant effects in MES, PTZ and INH induced seizure models, where the higher dose had similar efficacy action to diazepam and full protection of mortality. The extract was found to inhibit the seizures, slow down the onset of seizures, decreased convulsion duration and preserved hippocampal and cortical architecture. These results indicate that the possible mechanisms through which HEIE can alter its effects are by regulating GABAergic neurotransmission and ion channels together with the potential antioxidant-mediated neuroprotection.

It can be inferred that Ipomoea eriocarpa has a potential as a possible alternative or complementary therapy agent in the management of epilepsy because of its effectiveness and natural nature. Mechanistic, pharmacokinetic, and clinical studies should be continued to determine its safety and efficacy and its clinical applicability to humans.

ABBREVIATIONS

I.eriocarpa- *Ipomoea eriocarpa*, **HEIE-** Hydroalcoholic Extract of *Ipomoea eriocarpa,* **SD-** standard deviation, **PTZ-** pentylenetetrazol, **MES-** maximal electroshock, **INH-** isoniazid **SC**- subcutaneous, **i.p-** intraperitoneal, **P.O.-** per oral, **Hz-** hertz, **mA-** milliampere, **CCSEA-** Committee for the Control and Supervision of Experiments on Animals, **IAEC-** International Animal Ethics Committee, **ILAE-** International League against Epilepsy, **IBE-** International Bureau for Epilepsy, **ASM-**anti-seizure medication

ACKNOWLEDGMENT

The authors convey their sincere appreciation and indebtedness to Professor Phool Chandra and Associate Professor Ashish Singhai of Teerthanker Mahaveer University, Moradabad (U.P.), India, for their unwavering encouragement and assistance at the College of Pharmacy laboratories.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

FUNDING

Not applicable.

REFERENCES

1. Neligan A, Hauser WA, Sander JW. The epidemiology of the epilepsies. Handb Clin Neurol. 2012;107:113–33.
2. Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE, Engel J, Forsgren L, French JA, Glynn M, Hesdorffer DC, Lee BI, Mathern GW, Moshé SL, Perucca E, Scheffer IE, Tomson T, Watanabe M, Wiebe S. ILAE Official Report: A practical clinical definition of epilepsy. Epilepsia. 2014;55(4):475–82.
3. Manwani Komal, Porwal Mayur. View of Advancement Of Detecting Epilepsy Concerning Biomarkers. International Journal of Pharma Professional's Research. 2025;16(2):91–103.
4. Wang Z, Lu G, Zhang Z, Zhong Y, Jiao Q, Zhang Z, Tan Q, Tian L, Chen G, Liao W, Li K, Liu Y. Altered resting state networks in epileptic patients with generalized tonic-clonic seizures. Brain Res. 2011 Feb 16;1374:134–41.
5. Andermann F, Guerrini R. The Causes of Epilepsy Common and Uncommon Causes in Adults and Children.
6. Beghi E. The Epidemiology of Epilepsy. Neuroepidemiology. 2020 Mar 17;54(2):185–91.
7. Fisher RS, Van Emde Boas W, Blume W, Elger C, Genton P, Lee P, Engel J. Epileptic seizures and epilepsy: Definitions proposed by the International League Against Epilepsy (ILAE) and the International Bureau for Epilepsy (IBE). Epilepsia. 2005 Apr;46(4):470–2.
8. Singh A, Trevick S. The Epidemiology of Global Epilepsy. Neurol Clin. 2016 Nov 1;34(4):837–47.
9. Fisher RS, Bonner AM. The Revised Definition and Classification of Epilepsy for Neurodiagnostic Technologists. Neurodiagnostic Journal. 2018 Jan 2;58(1):1–10.
10. Fiest KM, Sauro KM, Wiebe S, Patten SB, Kwon CS, Dykeman J, Pringsheim T, Lorenzetti DL, Jetté N. Prevalence and incidence of epilepsy. Neurology. 2017 Jan 17;88(3):296–303.
11. Hauser WA, Annegers JF, Kurland LT. Incidence of Epilepsy and Unprovoked Seizures in Rochester, Minnesota: 1935–1984. Epilepsia. 1993;34(3):453–8.
12. Camfield P, Camfield C. Incidence, prevalence and aetiology of seizures and epilepsy in children. Epileptic Disorders. 2015 Jun 1;17(2):117–23.
13. Jane Hanna N, J HN, Jws S. National Sentinel Clinical Audit of Epilepsy-Related Death REPORT. Introduction and Audit Methodology. 2002;
14. Ekstein D, Schachter SC. Natural Products in Epilepsy—the Present Situation and Perspectives for the Future. Pharmaceuticals. 2010;3(5):1426.
15. Schachter SC. Botanicals and Herbs: A Traditional Approach to Treating Epilepsy. Neurotherapeutics. 2009;6(2):415–20.
16. Vinotha T SA, S UM, M KT. ACUTE TOXICITY STUDY OF ARSENICUM ALBUM IN WISTAR ALBINO RATS. Int J Pharm Pharm Sci . 2024;16(12):37–41.
17. Porwal M, Kumar A, Maheshwari KK, Khan NA. Phytochemical, pharmacological screening and importance of marsdenia tenacissima: A review. IDMA. 2021 Apr 1;58(4):7–22.
18. Porwal M, Chandra P, Kumar V, Verma N, Monika Km. Evaluation of the Oral Toxicity of Litchi chinensis Pericarp Extract in Experimental Rats. Orient J Chem. 2023 Dec 27;39(6):1495–509.
19. Arika W, Kibiti CM, Njagi JM, Ngugi MP. In Vitro Antioxidant Properties of Dichloromethanolic Leaf Extract of Gnidia glauca (Fresen) as a Promising Antiobesity Drug. J Evid Based Integr Med. 2019;24:1–17.
20. Manwani K, Porwal Mayur. A Comprehensive Review of Botanical Characterization, Phytochemistry, Pharmacological Effects and Quality Control of Ipomoea Eriocarpa. Int J Environ Sci [Internet]. 2025 Sep 1 [cited 2026 Feb 11];11(23):866–82. Available from: https://theaspd.com/index.php/ijes/article/view/8416

21. Akmal T, Julianti AI, Syadza'ah Syamsudin S. POLYHERBAL FORMULATION OPTIMIZATION FROM CLITORIA TERNATEA, ROSMARINUS OFFICINALIS AND AQUILARIA MALACCENSIS USING SIMPLEX LATTICE DESIGN. Int J Appl Pharm. 2023;15(2):79–84.
22. MANWANI K, PORWAL M. LC-MS-Based Metabolite Profiling and Antioxidant Capacity Assessment of Ipomoea eriocarpa Extract. Oriental Journal Of Chemistry. 2024 Dec 1;40(6):1537.
23. Subash V, Dhanapal R. Cerebroprotective effect of Ipomoea eriocarpa against cerebral ischemia in rats. Int J Exp Pharmacol . 2012;2(1):13–8.
24. Thamizhvanan K, Kumuda P, Babu S. Evaluation of Antioxidant Activity of Whole Plant of Ipomoea Eriocarpa Extract. Innov Drug Discov. 2013;2(1):2012–3.
25. Kumar KKS. Evaluation of antisecretory activity of Ipomoea eriocarpa in albino Wistar rats. Int J Exp Pharmacol . 2012;2(1):19–25.
26. Shiva PP, Sarojini S. Antinociceptive Activity of Plant Extracts. Int J Res Pharm Pharm. 2012;1(1):85–8.
27. Naik ND, Reddy RG, Naadella BC. A study on Antipyretic Activity of Petroleum Ether Extract of Ipomoea Eriocarpa whole Plant. Int J Pharmacol Screen Meth. 2012;2(2):58–60.
28. Das M, Malipeddi H. Phytochemical Screening, GC-MS Analysis and Biological Activitiys of Ipomoea Eriocarpa Leaf Extracts. Int J Pharm Pharm Sci. 2014;6(4):592–4.
29. Das M, Malipeddi H. Antiurolithiatic activity of ethanol leaf extract of Ipomoea eriocarpa against ethylene glycol-induced urolithiasis in male Wistar rats. Indian J Pharmacol. 2016 May 1;48(3):270–4.
30. Khalifa AA, Mohamed A.A, Ibrheim Z.Z, Hamoda A.M., Mohamed AA. Macro-and Micromorphology of the Leaves, Stems, Seeds and Fruits of Ipomoea Eriocarpa (R. Br.) Growing in Egypt. Bull Pharm Sci, Assiut University. 2017;40:9–31.
31. Nyero A, Anywar GU, Achaye I, Malinga GM. Phytochemical composition and antioxidant activities of some wild edible plants locally consumed by rural communities in northern Uganda. Front Nutr. 2023 Apr 4;10:1070031.
32. Manwani K, Porwal M. LC-MS-Based Metabolite Profiling and Antioxidant Capacity Assessment of Ipomoea eriocarpa Extract. Oriental Journal Of Chemistry. 2024 Dec 25;40(6):1537–48.
33. Kokate C.K. Practical Pharmacognosy. 7th ed. Vallabh Prakashan; 1994. 112 p.
34. Manwani K, Islam MS, Porwal M. EVALUATION OF ACUTE AND SUBACUTE ORAL TOXICITY INDUCED BY HYDROALCOHOLIC EXTRACT OF IPOMOEA ERIOCARPA IN EXPERIMENTAL RATS. Asian Journal of Pharmaceutical and Clinical Research [Internet]. 2025 Aug 7 [cited 2026 Feb 11];18(8):66–74. Available from: https://journals.innovareacademics.in/index.php/ajpcr/article/view/55097
35. Wolfgang H. Vogel, Bernward A. Schokens, Jurgen Sandow. Drug Discovery and Evaluation: Pharmacological Assays. 2nd ed. Springer-Verlag; 2002.
36. Mahendran G, Thamotharan G, Sengottuvelu S, Bai VN. Evaluation of Anticonvulsant, Sedative, Anxiolytic, and Phytochemical Profile of the Methanol Extract from the Aerial Parts of Swertia corymbosa (Griseb.) Wight ex C.B. Clarke. Biomed Res Int. 2014;2014:542385.
37. Kore AP, Naikwade NS, Ladda PL, Shikalgar TS, Patil SS. Evaluation of Anticonvulsant Activity of Ethanolic Extract of Leaves of Cajanus cajan (L) Millsp. In Rodents. International Journal of Pharmaceutical Sciences and Drug Research. 2019 Nov 30;11(6):330–6.
38. Bigoniya P, Sahu T, Tiwari V. Hematological and biochemical effects of sub-chronic artesunate exposure in rats. Toxicol Rep. 2015 Jan 1;2:280.
39. Long XY, Wang S, Luo ZW, Zhang X, Xu H. Comparison of three administration modes for establishing a zebrafish seizure model induced by N-Methyl-D-aspartic acid. World J Psychiatry. 2020 Jul 19;10(7):150.