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RESEARCH ARTICLE

ASSESSMENT OF SOME NEUROPHARMACOLOGICAL POTENTIAL OF METHANOL SEED EXTRACT OF *HUNTERIA UMBELLATA* IN EXPERIMENTAL ANIMAL MODELS

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ABSTRACT

This study evaluated the anxiolytic, sedative, antidepressant, and anticonvulsant effects of the methanol seed extract of *Hunteria umbellata* in mice using established experimental models, including the Elevated Plus Maze (EPM), Hole-board test, Rota-rod test, Forced Swim Test (FST), Tail Suspension Test (TST), Maximal Electroshock (MES)-induced convulsion, Strychnine-induced convulsion, Pentylenetetrazole (PTZ)-induced convulsion, and Phenobarbitone-induced sleeping time. Seeds were collected, dried, powdered, and extracted by Soxhlet maceration in methanol to obtain the crude extract. At doses of 250 and 500 mg/kg, the extract increased the duration of time spent in the open arms of the EPM, though not significantly, while at 1000 mg/kg it significantly ($p < 0.001$) reduced exploratory behavior in the Hole-board test, similar to the standard drug diazepam. No effect was observed on motor coordination in the Rota-rod test. In the FST and TST, the extract produced no significant changes in immobility or mobility duration compared to controls. The extract failed to protect against MES-induced seizures. In the Strychnine model, it slightly delayed seizure onset and prolonged convulsion duration but offered no protection against mortality. In PTZ-induced convulsions, 20% protection (1/4) was observed at 250 and 500 mg/kg, with a shortened onset and duration of seizures. At 1000 mg/kg, seizure duration increased, and all animals (4/4) died. In summary, H. umbellata seed extract demonstrated mild anxiolytic and antidepressant tendencies, with limited anticonvulsant effects. These findings partially support its traditional use in managing neuropsychiatric disorders. Further studies are required to isolate active constituents and elucidate underlying mechanisms of action.

KEYWORDS

Hunteria umbellata, anxiolytic, antidepressant, anticonvulsant, traditional medicine, animal models.

1. INTRODUCTION

Neurological disorders remain a major global cause of morbidity and mortality, often impairing the structure and/or function of the brain and spinal cord. Conditions such as depression, anxiety, epilepsy, stroke, dementia, Parkinson's disease, schizophrenia, psychosis, and sleep disorders constitute significant public health concerns worldwide, with their incidence steadily increasing (Chen et al., 2019; Ofokansi et al., 2021). It is estimated that between 2011 and 2030, mental disorders could account for a global economic loss of approximately 16.3 trillion dollars (Caulfield et al., 2019). Currently, around 450 million people worldwide are affected by mental health conditions, of which 121 million live with depression and about 65 million suffer from epilepsy (Mahendran et al., 2014; Dunham and Miya, 1957).

Among these, depression and anxiety rank as the most prevalent mental disorders, together contributing to over half of psychiatric and substance-use cases globally (Friedrich, 2017; Droahna et al., 2023; Whiteford et al., 2010; Hoeflich et al., 2023). Approximately 4–5% of the world's population is affected by either depression or anxiety (Javaid et al., 2023). Depression, which impacts individuals across all age groups and backgrounds, is considered the fourth leading cause of overall disease burden and the primary contributor to nonfatal disease burden worldwide (GBD, 2017; Bello et al., 2021; Ibrahim et al., 2024; Yiend et al., 2009). Anxiety disorders, expressed in forms such as post-traumatic stress, obsessive-compulsive disorder, panic disorder, or social anxiety, are equally significant, often requiring medical intervention due to their chronic and disabling nature (Kabir et al., 2015). While depression is typically associated with symptoms such as sadness, loss of interest, disturbed sleep, poor appetite, reduced functionality, and suicidal ideation in severe cases, anxiety is largely characterized by chronic fear triggered by real or perceived threats (Shah et al., 2022; WHO, 2017).

Epilepsy represents another critical neurological condition, caused by recurrent abnormal electrical discharges within the brain, resulting in repeated seizures and partial or complete loss of consciousness (Danmalam et al., 2017; Gudaji et al., 2024; Mucklow, 2000). It affects roughly 70 million individuals globally, with nearly 80% of cases occurring in low- and middle-income countries (Yemadje et al., 2009; WHO, 2012; Gudaji et al., 2024). Moreover, up to half of patients with epilepsy are known to develop psychiatric comorbidities, particularly depression, anxiety, and psychotic disturbances (Marsh and Rao, 2012; Akhigbemen et al., 2019). The etiology may involve infections, trauma, metabolic disturbances, or tumors, though many cases are idiopathic with genetic predispositions implicated (Brodie et al., 2016). For centuries, humans have relied on plants for both nutritional and therapeutic purposes. The

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global use of medicinal plants has significantly increased in recent times, contributing to the development of nearly 25% of modern pharmaceuticals (Thomford et al., 2015; Effiong et al., 2020). According to the World Health Organization, approximately 80% of the world's population depends on medicinal plants for primary health needs, with even higher usage rates in African countries (Mahomoodally, 2013; Akinyemi et al., 2019; Sofowora et al., 2013; Abd El-Ghani, 2016). This widespread use is driven by factors such as the affordability of herbal products, perceived safety compared to synthetic medicines, limited availability of conventional drugs, and the side effects associated with orthodox therapies (Mpinga et al., Njan et al., 2019; Liu et al., 2016; Rahman et al., 2017; Thomford et al., 2015; Karimi et al., 2015).

Hunteria umbellata, a small evergreen tree belonging to the family Apocynaceae, is native to the tropical rainforests of Nigeria, Ghana, Gabon, and Cameroon (Aderele et al., 2020). In Nigeria, it is locally known as "Osu" (Edo), "Erinor abeere" (Yoruba), and "Nkpokiri" (Igbo) (Boone, 2006; Okolafor and Ekhaise, 2021). The plant typically grows between 15 and 22 meters tall, with broad leaves, a dense crown, and yellow fruits containing seeds embedded in gelatinous pulp (Boone, 2006; Ofokansi et al., 2021). Traditionally, various parts of the plant are used in the management of numerous ailments including sexually transmitted infections, induction of labor, dysmenorrhea, fever, infertility, helminthic and bacterial infections, peptic ulcer, piles, yaws, and diabetes (Falodun et al., 2006; Anibijuwan et al., 2011; Elujoba, 1995; Elujubo et al., 2005; Oluwemimo and Usifoh, 2001; Igbe et al., 2009).

Despite its wide ethnomedicinal applications, little is known about the neuropharmacological properties of *Hunteria umbellata*. While existing literature highlights diverse therapeutic potentials of the plant, no substantial evidence has been documented on its anxiolytic, antidepressant, or anticonvulsant effects. This study therefore seeks to evaluate these activities in the methanol seed extract of H. *umbellata,* thereby filling an important gap in the understanding of its neuropharmacological potential.

2. Materials And Methods

2.1 Collection and Authentication of Plant Material

The seeds of Hunteria umbellata were obtained from a local market in Benin City, Nigeria. Authentication was carried out by Professor H. A. Akinnibosun of the Department of Plant Biology and Biotechnology, Faculty of Life Sciences, University of Benin, Benin City. A voucher specimen (UBH-H557) was deposited in the departmental herbarium for reference.

2.2 Preparation of Extract

Seeds were separated from ripe fruits, air-dried to a constant weight for three weeks, and ground into fine powder using a mechanical grinder. A total of 800 g of powdered material was cold-macerated in 3 L of methanol for 72 h. The mixture was filtered through wire gauze and sieve, after which the filtrate was concentrated to dryness in a water bath at 40 °C. The dried extract was stored in an airtight glass container under refrigeration until required for experiments.

2.3 Experimental Animals

Healthy mice and rats of either sex were sourced from the Laboratory Animal House, Department of Pharmacology and Toxicology, University of Benin. Animals were allowed two weeks of acclimatization before experimentation and maintained under standard laboratory conditions (12 h light/dark cycle, temperature-controlled environment) with unrestricted access to feed (Vital Grower's pellets, Jos, Nigeria) and water. All experimental procedures complied with institutional and international guidelines for the care and use of laboratory animals (Ozolua et al., 2009).

2.4 Chemicals and Drugs

The following agents were employed: phenobarbitone, imipramine, pentylenetetrazole (PTZ), strychnine, methanol, ethanol (Sigma-Aldrich Inc., St. Louis, MO, USA), normal saline (Fidson Healthcare Plc, Sango-Ota, Ogun State, Nigeria), Tween-80, and diazepam (Rotexmedica, Trittau, Germany). Methanol was used for extraction, ethanol for cleaning apparatus, PTZ and strychnine for seizure induction, diazepam as positive control, while normal saline served as negative control and for extract reconstitution

2.5 Anxiolytic Tests

2.5.1 Elevated Plus Maze (EPM)

The EPM apparatus consisted of two open (50 × 10 cm) and two closed arms (50 × 10 × 40 cm) joined by a central platform (10 × 10 cm). The maze, elevated 50 cm above the floor, was located in a dimly lit room (54). Twenty-five mice were divided into five groups (n=5). Group I received normal saline (5 ml/kg, i.p.), Groups II–IV received 250, 500, and 1000 mg/kg of the extract orally, while Group V was administered diazepam (2 mg/kg, i.p.). Thirty minutes after treatment, each mouse was placed at the maze center and observed for 5 min. The number of entries and time spent in open and closed arms were recorded. The apparatus was cleaned thoroughly between trials.

2.5.2 Hole-Board Test

The hole-board apparatus (40 × 40 cm) contained 16 evenly spaced holes (3 cm diameter each), elevated 43.2 cm above the floor. Following the protocol of (10, 62), mice were assigned into five groups as described above (Boissier and Simon, 1962). Thirty minutes post-treatment, each animal was placed at the center of the board, and head dips were counted for 5 min using a tally counter.

2.5.3 Rota-Rod Test

Motor coordination was assessed using the rota-rod test (Dunham and Miyya, 1957; Perez et al., 1998). Mice were pre-screened on a rotating rod (2.5 cm diameter, 20 rpm) elevated 25 cm from the floor. Animals that remained on the rod for at least 120 s were selected and randomized into five groups. Groups were treated as described previously. Thirty minutes post-treatment, mice were placed individually on the rod, and latency to fall was recorded over ten trials.

2.6 Antidepressant Tests

2.6.1 Forced Swim Test (FST)

The FST was conducted as described by (Porsolt et al., 1977; Vogel and Vogel, 1997). Mice were assigned into five groups (n=5). Groups I–IV received saline (0.2 ml), 250, 500, and 1000 mg/kg of the extract, respectively, while Group V received imipramine (25 mg/kg, p.o.). One hour later, animals were placed individually in glass cylinders (25 × 25 cm) containing 15 cm of water for 6 min. The first 2 min was for acclimatization, while immobility time was recorded during the last 4 min.

2.6.2 Tail Suspension Test (TST)

Following the procedure of mice were suspended by their tails using adhesive tape for 6 min (Steru et al., 1985; Tang et al., 2017). Treatment groups were as outlined above. The first 2 min was acclimatization, and immobility during the last 4 min was recorded.

2.7 Anticonvulsant Tests

2.7.1 Maximal Electroshock (MES)-Induced Convulsions

MES-induced seizures were elicited using an electroconvulsiometer (Ugo Basile 16,182). Mice were divided into five groups (n=5) and treated with saline, extract (250–1000 mg/kg), or phenobarbitone (30 mg/kg, i.p.). One hour post-treatment, seizures were induced (50 mA, 0.2 s, via ear clip electrodes), and onset/duration of tonic hind limb extension was recorded (Swinyard and Kupferberg, 1985; Winyard et al., 1989).

2.7.2 Strychnine-Induced Convulsions

Groups of mice (n=5) received saline, extract (250–1000 mg/kg), or diazepam (2 mg/kg, i.p.). One hour later, strychnine (1 mg/kg, i.p.) was administered (Porter et al., 1984; Akigbemen et al., 2019). Animals were observed for 30 min, and onset, duration of seizures, and mortality were recorded.

2.7.3 Pentylenetetrazole (PTZ)-Induced Convulsions

Convulsions were induced with PTZ (70 mg/kg, i.p.) 1 h after treatment (Vogel and Vogel, 1997). Seizure onset and duration were observed for 30 min.

2.7.4 Phenobarbitone-Induced Sleeping Time

This test followed the method of (Fujimori, 1965). Groups of mice (n=4) were treated with saline, extract (250–1000 mg/kg), or diazepam (2 mg/kg, i.p.), followed by phenobarbitone (40 mg/kg, i.p.) after 30 min. Onset and duration of sleep were recorded.

2.8 Statistical Analysis

Data were expressed as mean ± SEM and analyzed using one-way ANOVA in GraphPad Prism (version 6.0, GraphPad Software, San Diego, USA).

3. Results

Table 1: Mean values of the effect of methanol seed extract and Diazepam on the time spent by mice in the open and closed arm of the elevated plus maze apparatus

Treatment	Open Arm	Closed Arm
Control (Distilled water 10ml/Kg)	0.00 ± 0.00	300 ± 0.00
Group II (250 mg/Kg)	8.250 ± 4.97	291.8 ± 4.97
Group III (500mg/Kg)	12.25 ± 5.66	287.8 ± 5.66
Group IV (1000mg/Kg)	6.750 ± 1.80	283.3 ± 11.18
Standard (Diazepam 2mg/Kg)	31.50 ± 19.71	268.5 ± 19.71

Data are presented as mean ± S.E.M, n = 5. P>0.05: Not significantly different from control and standard group.

Table 2: Mean values of the effect of methanol seed extract and Diazepam (standard drug) on number of head dips and number of holes head dipped by mice.

Groups	Number of Head Dips	Number of Holes
Control	16.50 ± 2.217*	9.250 ± 1.887**
250 mg/kg	20.00 ± 3.916	8.000 ± 0.9129
500 mg/kg	11.50± 1.443	6.750 ± 0.4787
1000 mg/kg	6.250 ± 2.056*	2.50 ± 0.8660**
Standard	5.000 ± 1.155*	3.250 ± 0.4787**

Values are given as Mean ± SEM, (n = 5); ** = P < 0.05, which represent significant levels as compared with the control values and standard.

Table 3: Mean values of the effect of methanol seed extract and Diazepam (standard drug) on the time spent on Rota rod apparatus.

Treatment	Post-treatment 30 (min)	Time on rod 60 (sec)
Control (Distilled water10 ml/kg)	93.75 ± 26.25	84.00 ± 23.34
250 mg/kg	109.00 ± 11.00	94.75 ± 25.25
500 mg/kg	87.50 ± 22.86	93.75 ± 26.25
1000 mg/kg	95.00 ± 14.41	120 ± 0.0
Standard (diazepam 2 mg/Kg)	120.00 ± 0.0	78.75 ± 23.84

Data are presented as mean ± S.E.M, n = 5. P > 0.05: Not significantly different from control and standard group.

Table 4: Mean values of the effects of methanol extract of Hunteria umbellata seed on the duration of mobility and immobility in forced swim test.

Treatment	Mobility	Immobility
Control (Distilled water 10ml/Kg)	168.3±25.20	136.5±31.77
Group II (250 mg/Kg)	130.0±16.62	109.50±16.38
Group III (500mg/Kg)	114.3±42.42	125.00±41.40
Group IV (1000mg/Kg)	121.3±53.52	57.75±46.65
Standard (Imipramine 10mg/Kg)	172.8±37.77	67.00±37.84

Data are presented as mean ± S.E.M, n = 5. P>0.05: Not significantly different from control and standard group.

Table 5: Mean values of the effects of methanol extract of Hunteria umbellata seed on the duration of mobility and immobility in tail suspension test.

Treatment	Mobility	Immobility
Control (Distilled water 10ml/Kg)	98.50 ± 29.26	137 ± 30.43
Group II (250 mg/Kg)	139.8 ± 11.91	96.75 ± 9.295
Group III (500 mg/Kg)	176.0 ± 36.78	79.33 ± 6.848
Group IV (1000 mg/Kg)	177.5 ± 36.78	72.50 ± 33.51
Standard (Imipramine 10 mg/Kg)	206.5 ± 19.64*	33.50 ± 19.64

Data are presented as mean ± S.E.M, n = 5. P>0.05: Not significantly different from control and standard group.

Table 6: Percentage protection of mice from maximal electroshock induced convulsion by methanol seed extract of H. *umbellata.*

Treatment	Percentage protection (%)
Control	0
250 mg/kg	0
500 mg/kg	0
1000 mg/kg	0
Standard (Phenobarbitone)	100

Data are presented as mean ± S.E.M, n = 4. P>0.05: Not significantly different from control and standard group.

Table 7: Mean values of the effects of methanol extract of Hunteria umbellata seed on the strychnine induced convulsion in mice.

Treatment	Onset of Action (sec)	Duration of Convulsion (sec)	% Protection
Control (Distilled water 10ml/Kg)	315.00±37.75****	180.00±103.90	25
Group I (250 mg/Kg)	225.00±15.00	300.00±144.90	0
Group II (500 mg/Kg)	225.00±15.00	240.00±140.70	0
Group III (1000 mg/Kg)	270.00±30.00	0.00±0.00	0
Standard (Diazepam 2 mg/Kg)	0.0±0.0****	0.00±0.00	100

Data are presented as mean ± S.E.M, n = 4. P>0.05; Not significantly different from control group. ****p < 0.0001 When compared to diazepam group n=4 per group.

Table 8: Mean values of the effects of methanol extract of Hunteria umbellata seed on the Pentylenetetrazol induced convulsion in mice.

Treatment	Onset of convulsion (seconds)	Duration of convulsion (seconds)	Percentage (%) Protection
Control	210.0 ± 116.2	300.0 ± 64.81	25%
250 mg/kg	105.0 ± 28.72	210.0 ± 17.32	25%
500 mg/kg	135.0 ± 15.00	210.0 ± 38.73	25%
1000 mg/kg	90.00 ± 17.32	330.0 ± 143.9	0%
Standard	90.00 ± 30.00	135.0 ± 78.90	75%

Data are presented as mean ± S.E.M, n = 4. P>0.05: Not significantly different from control and standard group.

Table 9: Mean values of the effects of methanol seed extract of Hunteria umbellata on the Phenobarbitone induced Sleeping time in mice.

Groups	Onset of Sleep(s)	Duration of Sleep(s)
Control	3345 ± 1932	1125± 649.6**
250 mg/kg	930.0 ± 496.3	4035 ± 1514**
500 mg/kg	8580 ± 815.0**	1920 ± 674.8
1000 mg/kg	5115 ± 1053**	3030 ± 62.45**
Standard	1440 ± 757.0*	17.10 ± 659.3***

Data are expressed as mean ± SEM (n=5). **P < 0.05; significantly different for both onset and duration of sleep.

4. Discussion

This study investigated the anxiolytic, antidepressant, and anticonvulsant properties of the methanol seed extract of *Hunteria umbellata* using established experimental animal models, including the elevated plus maze (EPM), hole-board, rota rod, forced swim test (FST), tail suspension test (TST), maximal electroshock (MES), strychnine, pentylenetetrazole (PTZ), and phenobarbitone-induced sleep models. The EPM is widely employed for assessing anxiety-like behaviors, as rodents naturally avoid open arms due to fear of exposure. Anxiolytic agents typically increase exploration and time spent in open arms (Wlaf and Frye, 2007; Porter et al., 1984).

Table 1 summarizes the effect of the methanol seed extract of Hunteria umbellata and diazepam on the time spent by mice in the open and closed arms of the elevated plus maze.

Control mice (distilled water, 10 ml/kg) remained exclusively in the closed arm (300 ± 0.00 s), showing no entry into the open arm. Treatment with the extract at 250, 500, and 1000 mg/kg produced modest increases in open arm exploration (8.25 ± 4.97 s, 12.25 ± 5.66 s, and 6.75 ± 1.80 s, respectively), accompanied by reduced time spent in the closed arms. Diazepam (2 mg/kg) markedly increased open arm activity (31.50 ± 19.71 s) and reduced closed arm duration (268.50 ± 19.71 s). Nonetheless, none of these changes reached statistical significance compared to either the control or standard group ($P > 0.05$). Since increased open-arm exploration suggests anxiolytic potential, the extract may possess mild anxiolytic activity, though weaker than the standard. Similarly, in the hole-board test, head-dipping reflects exploratory drive and reduced anxiety (Kabir et al., 2015; Kaluaeff and Tuohimaa, 2004; Crawley, 2007).

Table 2 shows the effects of the methanol seed extract of Hunteria umbellata and diazepam on exploratory behavior in the hole-board test. The control group exhibited a mean of 16.50 ± 2.22 head dips across 9.25 ± 1.89 holes. Administration of the extract at 250 mg/kg produced a slight, non-significant increase in head dips (20.00 ± 3.92) with a comparable number of holes explored (8.00 ± 0.91). At 500 mg/kg, the number of head dips decreased (11.50 ± 1.44), along with a reduction in the number of holes explored (6.75 ± 0.48). A more pronounced decline was observed at 1000 mg/kg, where head dips and holes dipped significantly reduced to 6.25 ± 2.06 and 2.50 ± 0.87, respectively ($P < 0.05$ vs. control). Similarly, diazepam (2 mg/kg) markedly reduced both parameters, with head dips at 5.00 ± 1.16 and holes explored at 3.25 ± 0.48 ($P < 0.05$ vs. control). These findings suggest a dose-dependent reduction in exploratory activity with higher doses of the extract, comparable to the effect of the standard anxiolytic.

Motor coordination and muscle relaxation in mice was assessed using the rota-rod test, as centrally acting agents often impair locomotion due to CNS depression (Vogel and Vogel, 1997; Bhattacharya et al., 2010; Shah et al., 2022). At 30 minutes post-treatment, mice treated with 250 mg/kg of the extract remained slightly longer on the rod (109.00 ± 11.00 sec) compared to control (93.75 ± 26.25 sec), whereas the 500 mg/kg and 1000 mg/kg groups showed values similar to the control. By 60 minutes, mice in the 1000 mg/kg group demonstrated the highest retention time (120.00 ± 0.00 sec), indicating no impairment in motor coordination. The standard diazepam group also recorded maximum retention at 30 min (120.00 ± 0.00 sec) but showed reduced performance at 60 min (78.75 ± 23.84 sec). Overall, the extract did not significantly alter motor coordination compared to control ($P > 0.05$), suggesting it lacks muscle relaxant or motor-impairing effects (Table 3).

The antidepressant potential of the extract was evaluated using the FST and TST, which are standard behavioral models sensitive to serotonergic and noradrenergic modulation (Akhigbemen et al., 2022; Cryan et al., 2005; Xu et al., 2008). The forced swim test is used to evaluate antidepressant effect of drugs. Exposure to stress plays an important role in depression (Akhigbemen et al., 2022). The characteristic behavior evaluated in these tests, termed mobility or immobility has been considered to reflect behavioral despair similar to that seen in human depression (Akhigbemen et al., 2022). Tail suspension test (TST) is an important behavioral models widely and routinely used for screening new antidepressant compounds and plants (Cryan et al., 2005). In the forced swim test, treatment with H. *umbellata* seed extract showed variable effects on mobility and immobility time. The control group spent 168.3 ± 25.20 sec in mobility and 136.5 ± 31.77 sec in immobility. At 250 mg/kg and 500 mg/kg, mobility decreased to 130.0 ± 16.62 sec and 114.3 ± 42.42 sec, respectively, with corresponding immobility times of 109.5 ± 16.38 sec and 125.0 ± 41.40 sec.

Notably, the 1000 mg/kg group displayed markedly reduced immobility (57.75 ± 46.65 sec) compared with control, approaching the response observed with the standard antidepressant, imipramine (67.0 ± 37.84 sec). Findings from this study noted that the plant extract reduced the duration of mobility and immobility time (seconds) in the forced swim test (Table 4). The data suggest a trend toward antidepressant-like activity at higher doses of the extract. This antidepressant-like effect may be associated with serotonergic mechanisms (Zheng et al., 2013; GBD, 2017). Although, these differences did not reach statistical significance ($P > 0.05$). In the tail suspension test, control mice spent 98.50 ± 29.26 sec in mobility and 137.0 ± 30.43 sec in immobility. Treatment with H. *umbellata* seed extract at 250 mg/kg increased mobility to 139.8 ± 11.91 sec and reduced immobility to 96.75 ± 9.30 sec. At higher doses (500 and 1000 mg/kg), mobility further increased to 176.0 ± 36.78 sec and 177.5 ± 36.78 sec, with corresponding reductions in immobility (79.33 ± 6.85 sec and 72.50 ± 33.51 sec, respectively). The standard drug, imipramine, produced the greatest antidepressant effect, with mobility of 206.5 ± 19.64 sec and immobility of 33.50 ± 19.64 sec. Although statistical analysis indicated no significant differences ($P > 0.05$), the extract showed a dose-dependent trend toward reducing immobility, suggestive of modest antidepressant-like activity (Table 5).

The anticonvulsant activity was tested across MES, strychnine, and PTZ models. Results from this study (Table 6) showed that the extract failed to protect against electroshock-induced hind limb extension, unlike phenobarbitone which conferred 100% protection. The methanol seed extract of H. umbellata offered no protection against MES-induced seizures at all tested doses (250–1000 mg/kg), as all the treatment groups recorded 0% protection, comparable to the control group. In contrast, the standard drug phenobarbitone produced 100% protection, completely preventing tonic hind limb extension in all treated mice. These results suggest that the extract does not exhibit protective activity in the MES seizure model, which is typically predictive of efficacy against generalized tonic-clonic seizures. The extract could not act via voltage-gated sodium channel inhibition, a mechanism typical of drugs effective in generalized tonic–clonic seizures (DeLorenzo et al., 2001; Loscher, 2016). In the strychnine-induced seizure model, (Table 7) administration of methanol seed extract of H. *umbellata* (250–1000 mg/kg) did not confer significant protection against strychnine-induced convulsions in mice. The onset and duration of seizures in extract-treated groups were comparable to the control group, with 0% protection recorded across doses.

Interestingly, the 1000 mg/kg group showed seizure onset but no measurable duration, although this did not translate to protection. In contrast, diazepam (2 mg/kg) completely prevented convulsions, providing 100% protection. These results indicate that the extract lacks anticonvulsant efficacy in this strychnine seizure model. Similarly, in the PTZ model, the methanol seed extract of H. *umbellata* (250–1000 mg/kg) produced no significant protection against PTZ-induced seizures in mice. The onset and duration of convulsions across treatment groups were similar to the control, with protection rates ranging from 0–25%. At the highest dose (1000 mg/kg), the extract even showed 0% protection. In contrast, diazepam (2 mg/kg) significantly reduced seizure duration and provided 75% protection, confirming its expected anticonvulsant activity. These findings suggest that the extract does not exert measurable anticonvulsant effects in the PTZ model, which is predictive of efficacy against absence and myoclonic seizures (Table 8).

Phytochemical investigations of *Hunteria umbellata* have demonstrated the presence of alkaloids, flavonoids, tannins, saponins, and terpenoids, compounds often implicated in neuropharmacological activity (Elujoba, 1995; Elujoba et al., 2005; Oluwemimo and Udifah, 2001). Alkaloids are known to interact with neurotransmitter systems such as γ-aminobutyric acid (GABA), serotonin (5-HT), and dopamine, thereby influencing anxiolytic and antidepressant responses (GBD, 2017; Walf and Frya, 2007). Flavonoids possess both antioxidant and neuromodulatory properties and have been shown to enhance GABAergic or serotonergic transmission, which could explain the mild anxiolytic and antidepressant tendencies observed in this study (Kabir et al., 2015; Kaluaeff and Tuohima, 2004; Zheng et al., 2013). Saponins, on the other hand, have been associated with CNS depressant activity, consistent with the prolonged sleep duration observed in the phenobarbitone-induced sleep test (Brown and Nemes, 2008; Guragi et al., 2018). However, the absence of significant anticonvulsant activity suggests that the active constituents of the extract may not effectively modulate sodium or calcium ion channels, which are critical targets for seizure control (DeLorenzo et al., 2001; Loscher, 2016). Taken together, these findings suggest that while H. umbellata seed extract exhibits modest anxiolytic and antidepressant-like effects, further studies are required to isolate and characterize the bioactive compounds responsible, as well as to clarify their molecular mechanisms of action (Xu et al., 2008; Zheng et al., 2013).

5. Conclusion

In summary, the findings of this study indicate that the methanol seed extract of Hunteria umbellata exhibits moderate anxiolytic and antidepressant-like activities in experimental animal models, though the effects were not statistically significant across all parameters. These results support its traditional use in the management of mood-related disorders and highlight its potential as a source of bioactive compounds for the treatment of depression and anxiety. However, the extract showed no significant anticonvulsant activity in the maximal electroshock, strychnine, and PTZ-induced seizure models, suggesting limited efficacy in seizure control. Further studies are warranted to isolate and characterize the active phytoconstituents, elucidate their mechanisms of action, and evaluate safety profiles in order to fully establish the therapeutic potential of *Hunteria umbellata*.

Authors Contribution

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This work was carried out in collaboration between all authors. The study conception and design was done by the corresponding author, (James Odianosen, Oseyomon). Methodology: (Abigail Mebu, Akhigbemen) and (Philip Akugbe, Obarisiagbon). Preparation of materials, data collection and analysis were performed by (Philip Akugbe, Obarisiagbon), (Godswill, Ohiozua), and (Abigail Mebu, Akhigbemen) and (Sylvia, Iyoha). The literature search was managed by: (Winner, Ebhounaye) and (Stella Ndidiamaka, Nwaoke). The first draft of the manuscript was written by (James Odianosen, Oseyomon) and (Uati Victory, Usifo) and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Conflict Of Interest

On behalf of all the authors, the corresponding author wish to state that there is no conflict of interest.

Data Availability

All data generated and gathered during this study have been used in the manuscript.

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