Acute *in vivo* evaluation of the antidepressant-like activity of the aerial methanol extract of *Alysicarpus glumaceus* (Vahl) DC. and its fractions

Ferhat Khan*[1], Munir Ari Sani[2], Umarudeen Ajibola Monisola[3], Mohammed Garba Magaji[1], Ibrahim Abdu-Aguye[1], Isa Marte Hussaini[4]

[1]Department of Pharmacology and therapeutics, Ahmadu Bello University, Zaria-Nigeria
[2]Department of Veterinary Surgery and Radiology, Ahmadu Bello University, Zaria-Nigeria
[3]Department of Pharmacology and therapeutics, University of Abuja, Abuja-Nigeria
[4]Department of Pharmacology, University of Maiduguri, Maiduguri-Nigeria

Submitted: 7th August, 2026; Accepted: 23rd August, 2026; Published online: 31st August, 2026
DOI: https://doi.org/10.54117/jcbr.v6i4.5
**Corresponding Author:* Ferhat Khan; khanferhat@gmail.com; +2348033469257

Abstract

Depression is one of the most prevalent psychiatric disorders with complex and heterogeneous pathology and symptoms. Current classes of agents used in the management of depression are associated with a number of shortcomings. In Africa, some patients with depression use medicinal plants; however, evidence on the beneficial effects of these remedies remains limited. *Alysicarp*us *glumaceus (*AG) (family *Leguminosae*) is used in the management of depression in Nigeria. This study was undertaken to evaluate the antidepressant activity of the methanol extract (ME) of AG and its fractions in mice. The antidepressant-like activity of the extract and its fractions at 500, 1000 and 1500 mg/kg was evaluated using tail suspension test (TST) and forced swim test (FST). Stimulant activity was evaluated using a digital actophotometer while the novel object recognition test (NORT) was used to assess memory. Methanol Extract of *Alysicarpus glumaceus* reduced the duration of immobility following TST and FST in a dose-dependent manner. Only the extract at 1500 mg/kg significantly (p<0.01) and all the test doses of the extract significantly (p<0.05) reduced the duration of immobility in TST and FST respectively. However, the reduction produced by the fractions were not dose dependent. There was a non-significant decrease in spontaneous locomotor activity of ME and some fraction-treated groups, thus arguing against a general stimulant effect. Similarly, in the NORT, both the ME and its fractions (except hexane and residual aqueous fractions at 1500 mg/kg; and ethyl acetate fraction at 500 and 1000 mg/kg) had no effect on recognition memory after acute administration. In conclusion, the aerial ME of *Alysicarpus glumaceus* possesses antidepressant-like activity.

Keywords: Actophotometer; *Alysicarpus glumaceus*; Depression; Forced Swim Test; Tail Suspension Test, Spontaneous locomotor activity.

Introduction

Depression is the most common psychological disorder. Globally, approximately 332 million people across all age groups struggle with depression (GBD, 2021; WHO, 2025,). This can severely affect a patient's physical and mental well-being and overall quality of life (Zhang *et al.*, 2024). Depression is characterized by depressed mood, loss of interest in activities, cognitive impairment, sleep disturbances, tiredness, and suicidal thoughts (Abdel-Bakky *et al*., 2021). In addition to the presence of psychopathological symptoms, this disease is linked with the development of such chronic diseases as cardiovascular diseases,

diabetes mellitus, endocrine disorders, and cancer (Abdel-Bakky *et al*., 2021).

Although there are several classes of drugs used for the treatment of depression, the use of these drugs in clinical practice is limited due to delayed action, side effects, drug-drug interactions, treatment resistance, and limited availability of some medicines (Pathak *et al*., 2025). Therefore, the search for alternative antidepressant agents from diverse sources including medicinal plants has continued.

Alysicarpus glumaceus (Vahl) DC. (*Leguminosae*) is a plant that is used in the treatment of patients with symptoms of depression in northern Nigeria (personal communication). It is worth noting that although the plant is widely used for the treatment of depression, there is limited scientific evidence on the effectiveness of this medicinal plant as an antidepressant. The aim of the present study was to evaluate the acute antidepressant effect of the aerial methanol extract of *Alysicarpus glumaceus* and its fractions in mice through the use of behavioral tests such as the tail suspension test and forced swim test, as well as the novel object recognition test and actophotometer-based assessment of locomotor activity.

Materials and methods

Animals

Adult Swiss Albino mice (18–22 g) of either sex were obtained from the animal house facility of the Department of Pharmacology and Therapeutics, Ahmadu Bello University, Zaria, Nigeria. They were randomly allocated to groups and housed in standard polypropylene cages with standard laboratory lighting and room-temperature conditions and fed standard rodent feed and water *ad libitum.* All the experimental protocols were as approved by the Ahmadu Bello University Committee on Animal Use and Care (ABUCAUC) with approval number ABUCAUC/2018/076.

Collection and identification of *Alysicarpus glumaceus*

The whole plant of *Alysicarpus glumaceus* was collected from Turunku, Igabi Local Government Area, Kaduna State, Nigeria in September and authenticated by Mal M.D. Musa of the Department of Botany, Herbarium Section, Ahmadu Bello University, Zaria, Nigeria, by comparison with an existing specimen (voucher number 446).

Extraction

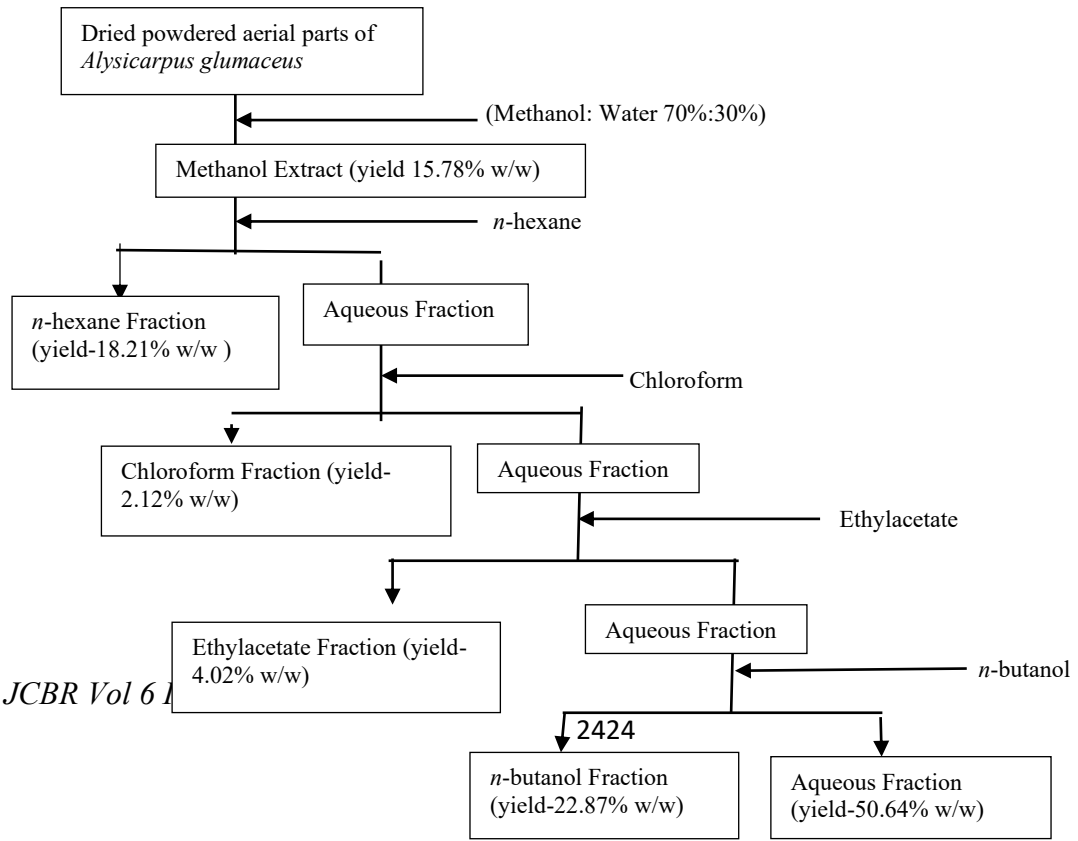

Figure 1: Fractionation Process of *Alysicarpus glumaceus*

After having completed the fractionation process as described in Figure 1, the methanol extract and its fractions were stored in a desiccator until use.

Tail suspension test (TST)

One hour before the test, the mice were taken into the neurobehavioural laboratory for adaptation, after they had been allocated to 6 groups (n =8 per group). Groups 1-3 were treated with the methanol extract of *Alysicarpus glumaceus* (MEAG) at 500, 1000 and 1500 mg/kg respectively, while group 4 was treated with Imipramine-IMI (20 mg/kg), fifth group with Citalopram-CITA (20 mg/kg) and group 6 with distilled water (10 mL/kg) via the oral route (*p.o*) one hour later, they were individually subjected to the test.

Briefly, each mouse was suspended on the edge of the rod of the TST apparatus by its tail fixed with an adhesive tape placed 1 cm from the tip of the tail to the rod. The rod was placed 58 cm from the base of the apparatus. The TST apparatus is constructed in a way that it takes 5 mice at a time with an opaque partition in between each mouse, such that the mice did not have contact with each other. The mice were suspended for 6 minutes and were videotaped for the entire period. The same procedure was repeated for all the extracts (fractions of methanol extract of *Alysicarpus glumaceus*). After each experiment the entire apparatus was cleaned with 70% alcohol to remove any olfactory cues before placing the next set of mice.

Forced swim test (FST)

Forty-eight (48) mice were divided into six groups (n=8). Groups 1-3 were treated with the methanol extract of *Alysicarpus glumaceus* at 500, 1000 and 1500 mg/kg respectively, while group 4 was treated with IMI (20 mg/kg), fifth group with CITA (20 mg/kg) and group 6 with distilled water (10 mL/kg) *p.o*. The mice were assessed by FST an hour after treatment and an hour prior to the test; the mice were taken into the neurobehavioural laboratory for adaptation.

Each mouse was forced to swim in a mouse forced swim cylinder (24 cm X 13 cm), with water of about 25ºC at a level of 15 cm. The mice were allowed to swim for 6 minutes and the entire procedure was recorded and duration of immobility was noted. The water from the cylinder after was poured away and freshly refilled for another set of experiment. An animal was judged to be immobile whenever it remained floating passively in the water in a slightly hunched but upright position with its nose just above the surface. The same procedure was repeated for all the extracts.

Spontaneous motor activity evaluation

The mice were assessed individually for 10 min in the actophotometer**.** Forty-eight (48) mice were divided into six groups (n=8). Groups 1-3 were treated with the test extract 500, 1000 and 1500 mg/kg respectively, while group 4 was treated with IMI (20 mg/kg), fifth group with CITA (20 mg/kg) and group 6 with distilled water (10 mL/kg) *p.o*. The test was done an hour after treatment. One hour before the test, the mice were taken into the neurobehavioural laboratory for adaptation.

The photocell activity cage or actophotometer was used to determine the degree of spontaneous motor activity which operates on photoelectric cells that are connected in circuit with a counter. When the beam of light falling on the photo cell is cut off by the animal, a count was recorded. The units of the activity counts were arbitrary and based on the beam breaks by movement of the mice (Nithya *et al.,* 2025) which is digitally displayed on the outside of the actophotometer. The entire arena was cleaned along with the tray below with 70%

alcohol swab after each mouse (to avoid any olfactory clue).

Novel object recognition test (NORT)

The method described by Ennaceur (2010) and modified by Gaskin *et al.* (2010) was used to assess recognition memory. The apparatus consists of a Plexiglas box of (28 cm x 40 cm x 18 cm). The NORT consists of three phases: the habituation, familiarization and testing phase. On day 1, mice were habituated to the open arena without any object for 2 minutes and returned to the home cage. On day 2, two identical objects were introduced into the arena placed 20 cm apart and 5 cm away from the walls of the apparatus. Each mouse was allowed to explore the identical objects for 10 minutes and returned to the home cage. On day 3 (test day), one of the objects was replaced with another (a novel object) of different size and colour. Seven groups (n=8) of 56 mice were randomly selected and were orally administered with 10 mL/kg DW (group 1), Imipramine 20 mg/kg (group 2), Citalopram 20 mg/kg (group 3), three graded doses of the extract (500, 1000 and 1500 mg/kg) that is, groups 4, 5 and 6, respectively, while the seventh group received piracetam (400 mg/kg).

An hour after drug administration, each mouse was placed in the middle of the box facing the wall and was freely allowed to explore for 5 minutes both the apparatus and the objects. The locomotor activity of mice was videotaped with a camera and the object exploration was hand scored by watching from the video. The time spent exploring the novel and familiar objects were recorded and the discrimination index of memory calculated (difference between novel and familiar object exploration). Object exploration was defined as orientation of the animal towards the object at a distance of $\leq$ 2 cm with the snout, sniffing and touching the object, while climbing or sitting on the object was not considered as exploration (Aggleton *et al.,* 2010). The same procedure was repeated for all the fractions.

Results

Effect of Methanol Extract of Alysicarpus glumaceus and its Fractions on Immobility of Mice Following the Tail Suspension Test

Methanol extract at 1500 mg/kg significantly (p<0.01) reduced the duration of immobility, when compared to the distilled water (10 mL/kg) group. The two standard drugs used also significantly (p<0.001) reduced the duration of immobility as shown in Figures 2a and 2b

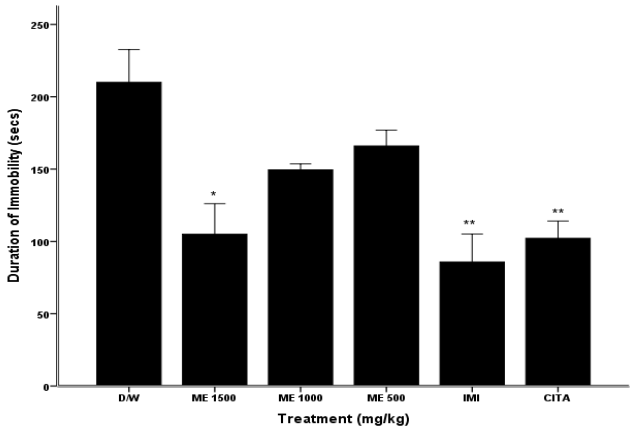

Figure 2a: Effect of Methanol Extract of *Alysicarpus glumaceus* on Duration of Immobility in Mice Following the Tail Suspension Test

Values presented as mean ± SEM, *p<0.01, **p<0.001 compared to distilled water; Data were analysed by One-Way ANOVA followed by Bonferroni post-hoc test, n=8; DW-Distilled Water (10 mL/kg), IMI- Imipramine (20 mg/kg), CITA- Citalopram (20 mg/kg) and ME-Methanol Extract of *Alysicarpus glumaceus*

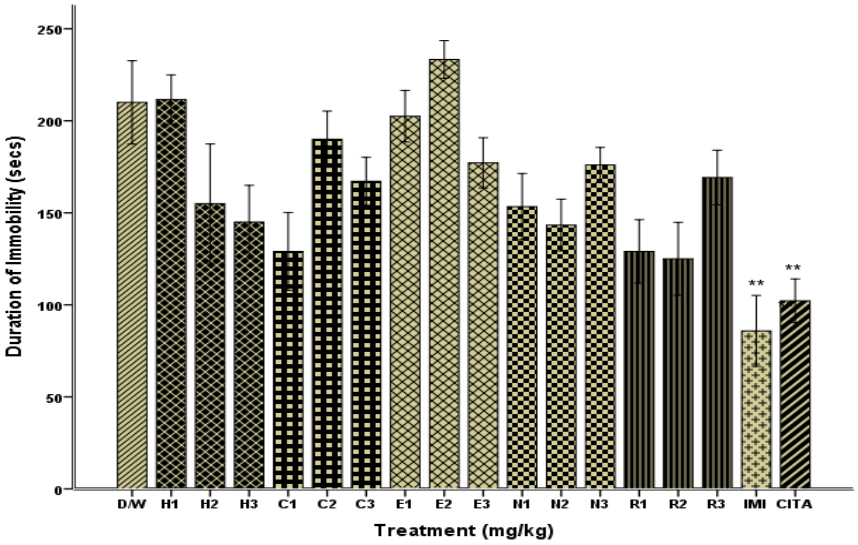

Figure 2b: Effect of Fractions of *Alysicarpus glumaceus* on Duration of Immobility in Mice Following the Tail Suspension Test

Values presented as mean ± SEM, **=p<0.001 compared to distilled water; Data were analysed by One-Way ANOVA followed by Bonferroni post-hoc test, n=8; DW-Distilled Water (10 mL/kg), H1-Hexane Fraction (1500 mg/kg), H2-Hexane Fraction (1000 mg/kg), H3- Hexane Fraction (500 mg/kg), C1- Chloroform Fraction (1500 mg/kg), C2- Chloroform Fraction (1000 mg/kg), C3- Chloroform Fraction (500 mg/kg), E1- Ethylacetate Fraction (1500 mg/kg), E2-Ethylacetate Fraction (1000 mg/kg), E3- Ethylacetate Fraction (500 mg/kg), N1- *n*-Butanol Fraction (1500 mg/kg), N2- *n*-Butanol Fraction (1000 mg/kg), N3- *n*-Butanol Fraction (500 mg/kg), R1- Residual Aqueous Fraction (1500 mg/kg), R2- Residual Aqueous Fraction (1000 mg/kg), R3- Residual Aqueous Fraction (500 mg/kg), IMI- Imipramine (20 mg/kg), and CIT-Citalopram (20 mg/kg).

Effect of Methanol Extract of Alysicarpus glumaceus and its Fractions on Duration of Immobility in Mice Following the Forced Swim Test

The results showed that the methanol extract, chloroform and ethylacetate fractions exhibited a dose-dependent decrease in duration of immobility. The methanol extract at 1500 mg/kg and ethylacetate fraction at 500 mg/kg significantly at (p<0.001) decreased the duration of immobility in comparison with the distilled water (10 mL/kg) group respectively. Citalopram and Imipramine also significantly (p<0.01) and (p<0.05) decreased the duration of immobility. (Figure 2a-b).

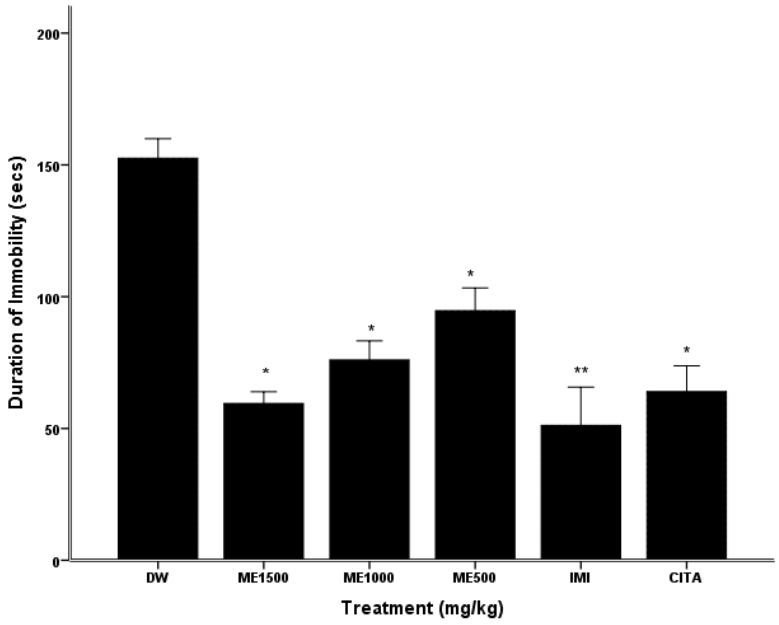

Figure3a: Effect of Methanol Extract of *Alysicarpus glumaceus* on Duration of Immobility in Mice Following the Forced Swim Test

Values presented as mean ± SEM, **p*<0.05, ***p*<0.01, compared to distilled water, Data were analysed by One-Way ANOVA followed by Bonferroni post-hoc test, n=8, DW- Distilled Water (10 mL/kg), IMI- Imipramine (20 mg/kg), CITA- Citalopram (20 mg/kg) and ME- Methanol Extract of *Alysicarpus glumaceus*

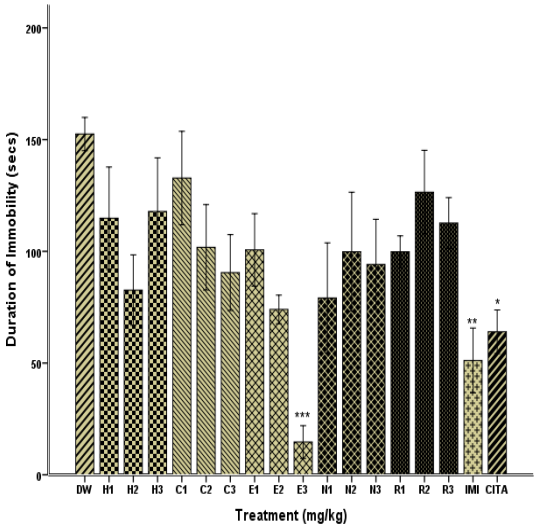

Figure 3b: Effect of Fractions of *Alysicarpus glumaceus* on Duration of Immobility in Mice Following the Forced Swim Test

Values presented as mean ± SEM, **p*<0.05, ***p*<0.01 and ****p*<0.001, compared to distilled water; Data were analysed by One-Way ANOVA followed by Bonferroni post-hoc test, n=8; DW- Distilled Water (10 mL/kg), IMI- Imipramine (20 mg/kg), CITA- Citalopram (20 mg/kg), H1- Hexane Fraction (1500 mg/kg), H2- Hexane Fraction (1000 mg/kg), H3- Hexane Fraction (500 mg/kg), C1- Chloroform Fraction (1500 mg/kg), C2- Chloroform Fraction (1000 mg/kg),

C3- Chloroform Fraction (500 mg/kg), E1- Ethylacetate Fraction (1500 mg/kg), E2- Ethylacetate Fraction (1000 mg/kg), E3- Ethylacetate Fraction (500 mg/kg), N1- *n*-Butanol Fraction (1500 mg/kg), N2- *n*-Butanol Fraction (1000 mg/kg), N3- *n*-Butanol Fraction (500 mg/kg), R1- Residual Aqueous Fraction (1500 mg/kg), R2- Residual Aqueous Fraction (1000 mg/kg) and R3- Residual Aqueous Fraction (500 mg/kg).

Effect of Methanol Extract of *Alysicarpus glumaceus* and its Fractions on Ambulatory Activity of Mice

There was no significant difference in the ambulatory activity of all methanol extract treated mice when compared to the DW treated group. However, hexane fractions at 1500 mg/kg and 1000 mg/kg as well as residual aqueous fractions at 1000 mg/kg significantly (p<0.001) increased the ambulatory activity of the mice. While chloroform and the ethylacetate fractions at all the doses tested did not significantly impact locomotor activity (Figure 4b)

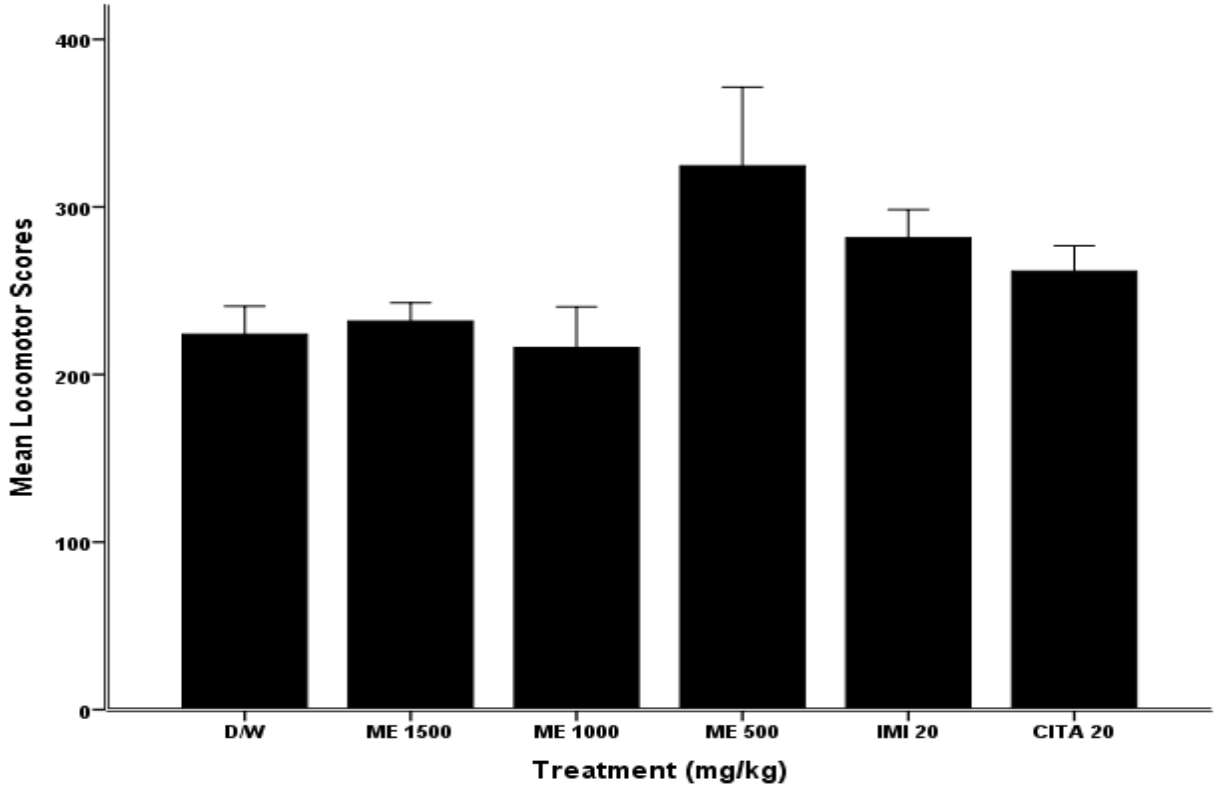

Figure 4a: Effect of Methanol Extract of *Alysicarpus glumaceus* on Ambulatory Activity of Mice

Values presented as mean ± SEM, No significant difference between the groups using One-Way ANOVA followed by Bonferroni post-hoc test, n=6; DW-Distilled Water (10 mL/kg), ME-Methanol Extract of *Alysicarpus glumaceus*, IMI- Imipramine and CITA- Citalopram

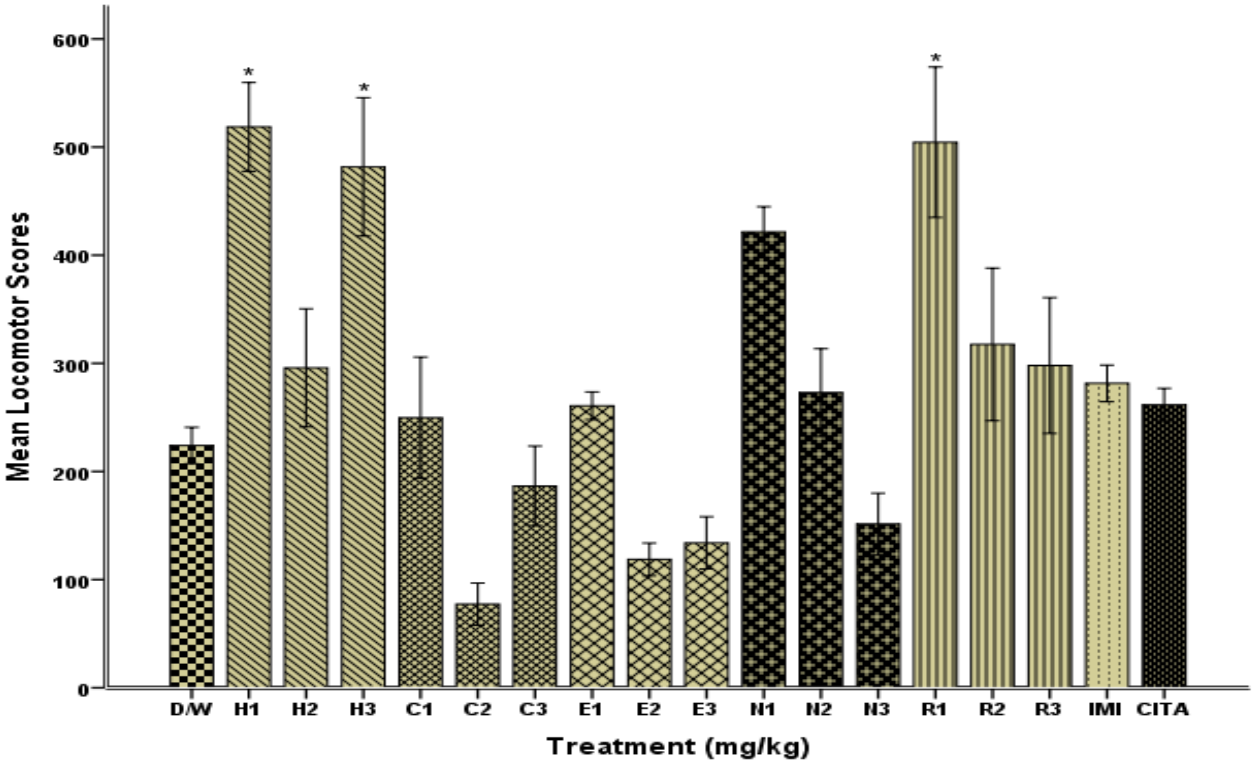

Figure 4b: Effect of Fractions of *Alysicarpus glumaceus* on Ambulatory Activity of Mice

Values presented as mean ± SEM, *p<0.05 compared to distilled water; Data were analysed by One-Way ANOVA followed by Bonferroni post-hoc test, n=6; DW-Distilled Water (10 mL/kg), H1-Hexane Fraction (1500 mg/kg), H2-Hexane Fraction (1000 mg/kg), H3- Hexane Fraction (500 mg/kg), C1- Chloroform Fraction (1500 mg/kg), C2- Chloroform Fraction (1000 mg/kg), C3- Chloroform Fraction (500 mg/kg), E1- Ethylacetate Fraction (1500 mg/kg), E2- Ethylacetate Fraction (1000 mg/kg), E3- Ethylacetate Fraction (500 mg/kg), N1- *n*-Butanol Fraction (1500 mg/kg), N2- *n*-Butanol Fraction (1000 mg/kg), N3- *n*-Butanol Fraction (500 mg/kg), R1- Residual Aqueous Fraction (1500 mg/kg), R2- Residual Aqueous Fraction (1000 mg/kg), R3- Residual Aqueous Fraction (500 mg/kg), IMI- Imipramine (20 mg/kg), and CIT- Citalopram (20 mg/kg)

Effect of Methanol Extract of *Alysicarpus glumaceus* and its Fractions in Mice on Exploration time of Identical, Novel Object and Discrimination Index in the Novel Object Recognition Test

In all the extract and fraction-treated mice, there was no significant difference between the time taken to explore the novel object to the familiar one when compared to the control group (DW treated group). Although, mice that received hexane fraction (1500 mg/kg), ethylacetate Fraction (1000 mg/kg) and Residual Aqueous Fraction (1500 mg/kg) showed a non-significant ability to discriminate between the two objects and as such explored more of the novel object as presented in Figures 4a-d.

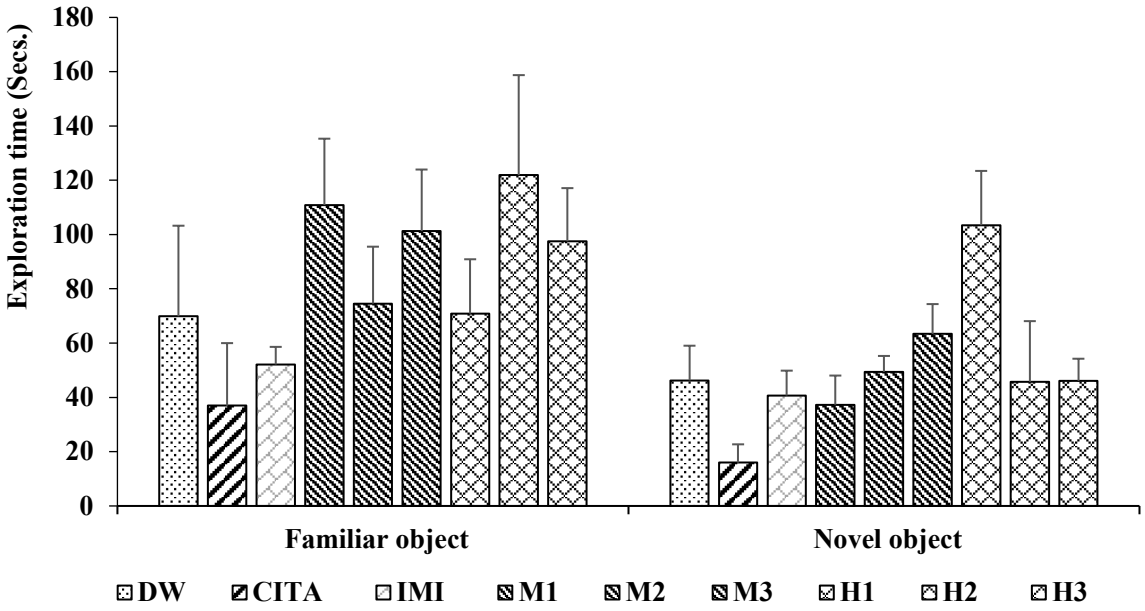

Figure 5a: Effect of Methanol Extract of *Alysicarpus glumaceus* and its Hexane Fraction in Mice on Exploration time of Identical and Novel objects in the Novel Object Recognition Test

Data are presented as mean ± SEM, compared to distilled water; Data were analysed by one-way ANOVA followed by Bonferroni post-hoc test, n=6; DW-Distilled Water (10 mL/kg), IMI- Imipramine (20 mg/kg), and CITA- Citalopram (20 mg/kg), M1-Methanol Extract (1500 mg/kg), M2-Methanol Extract (1000 mg/kg), M3-Methanol Extract (500 mg/kg), H1-Hexane Fraction (1500 mg/kg), H2-Hexane Fraction (1000 mg/kg), H3- Hexane Fraction (500 mg/kg),

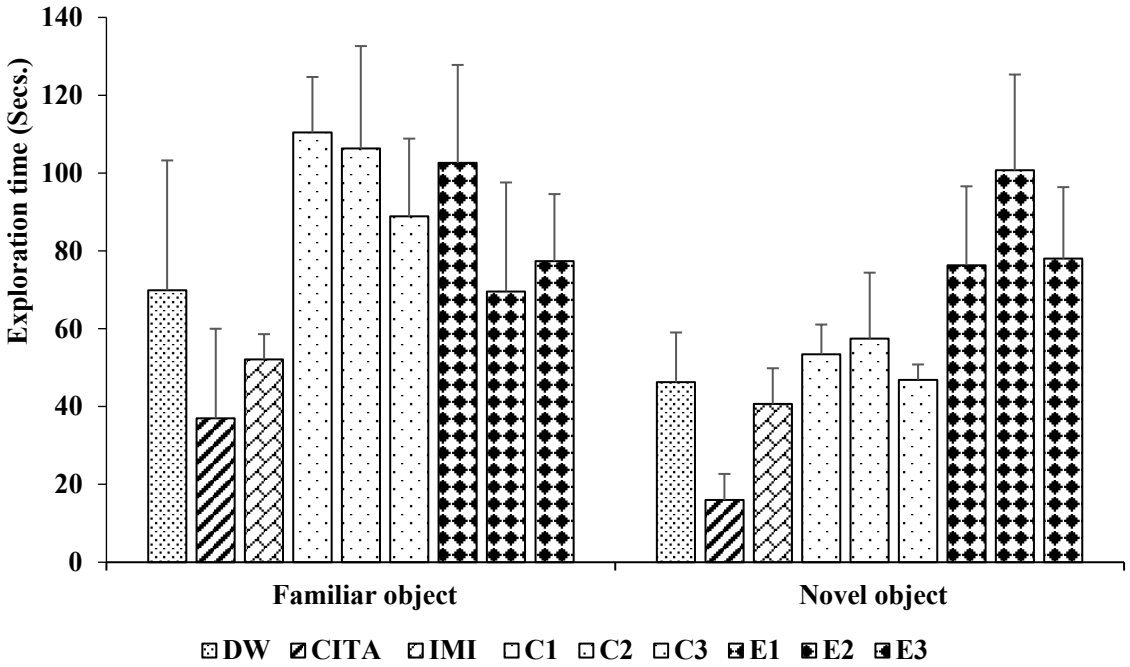

Figure 5b: Effect of Chloroform and Ethylacetate Fraction of *Alysicarpus glumaceus* in Mice on Exploration time of Identical and Novel objects in the Novel Object Recognition Test

Data are presented as mean ± SEM, compared to distilled water; Data were analysed by one-way ANOVA followed by Bonferroni post-hoc test, n=8; DW-Distilled Water (10 mL/kg), IMI- Imipramine (20 mg/kg), and CITA- Citalopram (20 mg/kg), C1- Chloroform Fraction (1500 mg/kg), C2- Chloroform Fraction (1000 mg/kg), C3- Chloroform Fraction (500 mg/kg), E1- Ethylacetate Fraction (1500 mg/kg), E2- Ethylacetate Fraction (1000 mg/kg), E3- Ethylacetate Fraction (500 mg/kg)

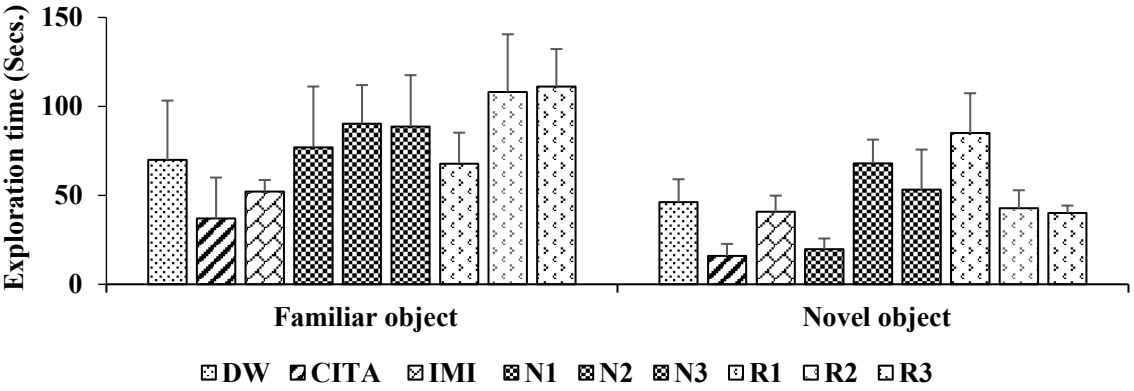

Figure 5c: Effect of *n*-Butanol and Residual Aqueous Fraction of *Alysicarpus glumaceus* in Mice on Exploration time of Identical and Novel objects in the Novel Object Recognition Test

Values presented as mean ± SEM, Data were analysed by one-way ANOVA followed by Bonferroni post-hoc test, n=8; DW-Distilled Water (10 mL/kg), IMI- Imipramine (20 mg/kg), and CITA- Citalopram (20 mg/kg), N1- *n*-Butanol Fraction (1500 mg/kg), N2- *n*-Butanol

Fraction (1000 mg/kg), N3- *n*-Butanol Fraction (500 mg/kg), R1- Residual Aqueous Fraction (1500 mg/kg), R2- Residual Aqueous Fraction (1000 mg/kg), R3- Residual Aqueous Fraction (500 mg/kg).

5d: Effect of Methanol Extract of and its Fractions on Discrimination Index in Novel Object Recognition Test in Mice

Methanol Extract of *Alysicarpus glumaceus* and its fractions at all the doses tested showed no significant difference in the discrimination index (DI) or recognition index (%) as evident in figure 4d. Mice treated with hexane fraction at 1500 mg/kg, ethylacetate fraction at 500 and 1000 mg/kg and residual aqueous fraction at 1500 mg/kg did show a slight increase in the DI, all were below 30%.

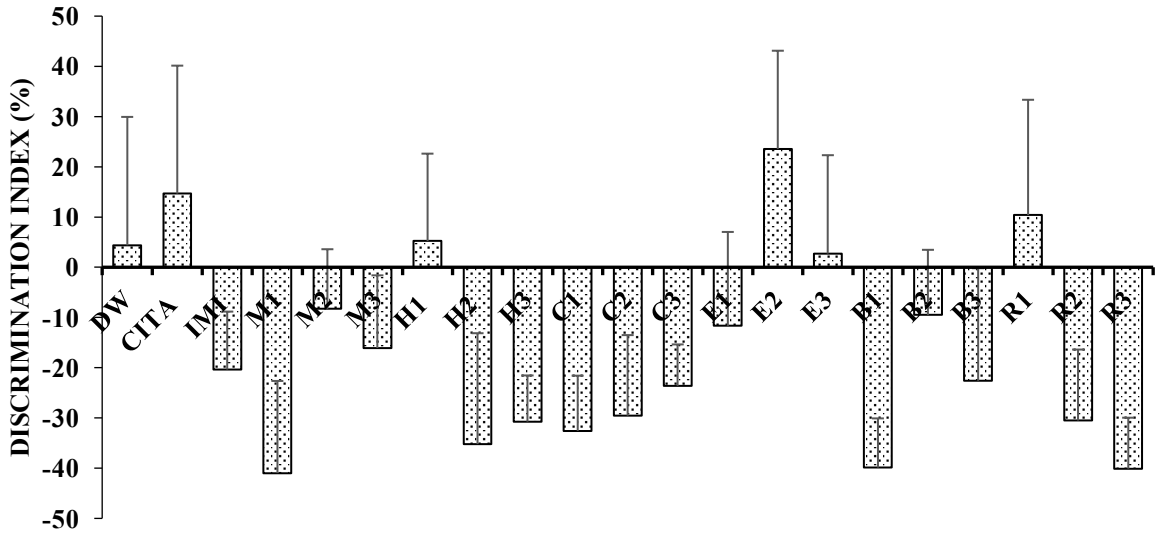

Figure 5d: Effect of Methanol Extract of *Alysicarpus glumaceus* and its Fractions on Discrimination Index in Novel Object Recognition Test in Mice

Values presented as mean ± SEM, compared to distilled water; Data were analysed by one-way ANOVA followed by Bonferroni post-hoc test, n=8; DW-Distilled Water (10 mL/kg), M1-Methanol Extract (1500 mg/kg), M2-Methanol Extract (1000 mg/kg), M3-Methanol Extract (500 mg/kg), H1-Hexane Fraction (1500 mg/kg), H2-Hexane Fraction (1000 mg/kg), H3- Hexane Fraction (500 mg/kg), C1- Chloroform Fraction (1500 mg/kg), C2- Chloroform Fraction (1000 mg/kg), C3- Chloroform Fraction (500 mg/kg), E1- Ethylacetate Fraction (1500 mg/kg), E2- Ethylacetate Fraction (1000 mg/kg), E3- Ethylacetate Fraction (500 mg/kg), N1-*n*-Butanol Fraction (1500 mg/kg), N2- *n*-Butanol Fraction (1000 mg/kg), N3- *n*-Butanol Fraction (500 mg/kg), R1- Residual Aqueous Fraction (1500 mg/kg), R2- Residual Aqueous Fraction (1000 mg/kg), R3- Residual Aqueous Fraction (500 mg/kg), IMI- Imipramine (20 mg/kg), and CIT- Citalopram (20 mg/kg)

Discussion

Methanol extracts and fractions of *Alysicarpus glumaceus* reduced the duration of immobility of the mice following tail suspension test (TST) and forced swim test (FST). However, while the impact of the methanol extract was dose dependent, that of the fractions were not. Ethylacetate fraction (500 mg/kg) significantly reduced the immobility time of mice following FST, but not TST. FST and TST are valuable and credible behavioral despair tests, which are used to screen all classes of antidepressants (Yan *et al.,* 2015). They are also used to assess phenotypic alterations relevant to depression by mimicking human depressive symptoms (Dedic *et al.,* 2011; Hsu *et al.,* 2015). The tests are based on the observation that mice, after initial escape-oriented movements, develop an immobile posture when placed in an inescapable situation. The antidepressant-like activity of an agent is assessed by its ability to decrease immobility time, an effect that is exhibited by conventional antidepressants (Bourin *et al.,* 2005; Reis *et al.,* 2014). Therefore, the methanol extract and some of its fractions reduced the immobility duration in mice, suggesting that it possesses antidepressant-like activity. Interestingly, the effect exhibited by the methanol extract at 1,500 mg/kg of *Alysicarpus glumaceus* was comparable to that of imipramine and citalopram in this study (figure 2a).

It is known that not all agents that decrease the immobility time following TST and FST will have antidepressant activity. For example, psychostimulants, convulsants and anticholinergics have been reported to reduce the immobility time, but are clinically ineffective as antidepressants (Sherman *et al.,* 1982; Bourin *et al.,* 2005; Cryan *et al.,* 2005). Therefore, assessment of locomotion was employed to rule out false positivity in the tests (Amitha and Torgal, 2016). The non-significant change in the locomotor scores observed in the extract and fractions treated groups suggested that the observed reduction in the duration of immobility from FST and TST may not be associated with CNS stimulation.

The methanol extract of and some of its fractions did not impact the mice's preference for the novel object during the test phase of NORT, implying the extracts did not have much effect on memory recognition. However, hexane fraction, residual aqueous fraction (both at 1500 mg/kg) and Ethylacetate fraction (500 mg/kg and 1000 mg/kg) increased discrimination index, which suggests that these fractions improved memory recognition. NORT is based on the natural instinct of mice to explore a novel object relative to a familiar one (Bevins and Besheer, 2006; Felice, *et al.,* 2015). This means the mouse would have recognized the familiar object over a variable length of time and as such, it would be observed spending less time exploring the familiar object compared to the novel one. This ability is referred to as recognition memory and it comprises familiarity, detection and recollection (Ennaceur and Delacour, 1988).

Phytoconstituents present in *Alysicarpus glumaceus* (Bawa, 2012; Khan *et al.,* 2021) may also be responsible for the antidepressant-like activity, as phytoconstituents have been reported to have many nutritive, biological and therapeutic properties (Benedec *et al*., 2013). Flavonoids, saponins and tannins have been found to possess appreciable anti-inflammatory and CNS action (Jäger and Saaby, 2011; Martínez-Coria *et al.,* 2023; Kruszka *et al.,* 2025). Depression is associated with inflammation (Maes *et al.,* 2012, Kiecolt-Glaser *et al.,* 2015; Phillips and Fahimi, 2018), and researchers have reported the link between inflammation and pathogenesis of depression (Pfau *et al.,* 2018). Inflammatory cascades such as increased concentrations of pro-

inflammatory cytokines of Interleukin 1 (IL-1), tumor necrosis factor (TNF) α and Interleukin 6 (IL-6), have been reported in depressed patients (Dowlati *et al.,* 2010; Liu *et al.,* 2012; Maes *et al.,* 2012; Bakunina *et al*., 2016). Flavonoids and neuroactive steroids were found to be ligands for GABA receptors in the CNS (Sajid *et al*., 2013). Tannins have been shown to possess antidepressant and anti-hemorrhagic activities (Pemminati *et al*., 2010). Flavonoids, terpenoids and tannins possess antioxidant activity (Dutta, 2013; Phani *et al*., 2015). Oxidative stress contributes to depression (Michel *et al.,* 2012; de Morais *et al.,* 2014; Bakunina *et al*., 2016), as evident by elevated oxidative stress status in depressed patients (Palta *et al.,* 2014). Triterpenoids have been reported to possess wide range of neuropharmacological activities like anxiolytic, sedative, hypnotic, antidepressant and antinociceptive (Scott *et al.*, 2004; Morris *et al.*, 2006; Parmar *et al*., 2013). Alkaloids, flavonoids, terpenoids, tannins and saponins also confer neuroprotection (Phani *et al*., 2015). Alkaloids and flavonoids have immunomodulatory activity (Middleton, 1998; Horrigan et al., 2006; Lantz *et al*., 2007; Ezeamuzie and Shihab, 2010; Kure *et al*., 2017).

Alysicarpus glumaceus has been found to be relatively safe (Khan *et al.,* 2022). The safety profile was further confirmed by the study done by Khan and co-researchers (Khan *et al.,* 2021), where no absorbance was observed at 2220-2260cm^{-1} region from their FT-IR data. This indicated absence of cyanide group, which is a toxicophore, suggesting plants can be considered to be safe (Ragavendran *et. al.,* 2011; Abdoun *et al*., 2019). Its relative safety may also support its folkloric use for the treatment of depression and other ailments.

Conclusion

Findings from the study showed that *Alysicarp*us *glumaceus* and its fractions possess antidepressant-like activity.

Acknowledgement

We appreciate the help rendered by the technical staff of Department of Pharmacology and Therapeutics, Ahmadu Bello University.

Conflict of interest

The authors declare no conflict of interest.

References

Abdel-Bakky MS, Amin E, Faris TM, Abdellatif AAH (2021): Mental depression: Relation to different disease status, newer treatments and its association with COVID-19 pandemic (Review). Mol Med Rep. Dec;24(6):839. doi: 10.3892/mmr.2021.12479.

Abdoun S, Hassan, TI, Gaber DA. El-Sharekh A (2019): Antidepressant activity of *A. hierochuntica* L. effervescent granules using forced swimming test. JIPBS. 6(2). 38-44.

Aggleton JP, Albasser MM, Aggleton DJ, Poirier GL, Pearce JM (2010): Lesions of the rat perirhinal cortex spare the acquisition of a complex configural visual discrimination yet impair object recognition. Behav. Neurosci. 2010(124): 55-68. doi: 10.1037/a0018320.

Amitha N, Torgal SS (2016): Effect of etidronate on depression paradigms in male swiss albino mice and wistar rats: an experimental study. Indian J Med Sci. 9: 217-224.

Bakunina N, Pariante CM, Zunszain PA (2016): Immune mechanisms linked to depression via oxidative stress and neuroprogression. *Immunology.* 96(3). 365–373.

Bawa B (2012): Phytochemical study and central nervous system activity of the plant *Alysicarpus glumaceus* (Vahl) DC. family: *legumunaceae*; (Unpublished master's dissertation). Ahmadu Bello University, Zaria-Nigeria.

Benedec D, Vlase L, Oniga I, Mot AC, Damian G, Hanguna D, Duma M, Silaghi-umitrescu R (2013): Polyphenolic composition, antioxidant and antibacterial activities for two romanian subspecies of *Achillea distans Waldst*. et Kit ex willd. Molecules. 18(8): 8725-8739. doi:10.3390/molecules18088725.

Bevins RA, Besheer J (2006): Object recognition in rats and mice: a one trial non-matching-to-sample learning task to study 'recognition memory'. Nat. Protoc. 1, 1306-1311.

Bourin M, Chenu F, Ripoll N, David DJP (2005): A proposal of decision tree to screen putative antidepressants using forced swim and tail suspension tests. Behav. Brain Res. 164. 266–269.

Cryan JF, Mombereau C, Vassout A (2005): The tail suspension test as a model for assessing antidepressant activity: review of pharmacological and genetic studies in mice. Neurosci. Biobehav. Rev. 29: 571e625.

Dedic N, Walser MS, Deussing MJ (2011): Mouse Models of Depression. In Psychiatric Disorders - Trends and Developments. InTech. doi:10.5772/27498.

de Morais H, de Souza CP, daSilva LM, Ferreira DM, Werner MF, Andreatini R (2014). Increased oxidative stress in prefrontal cortex and hippocampus is related to depressive-like behavior in streptozotocin-diabetic rats. Behav. Brain Res. 258: 52–64.

Dowlati Y, Herrmann N, Swardfager W (2010): A meta-analysis of cytokines in major depression. Biol. Psychiatry 67(5). 446-57.

Dutta J (2013): Phytochemical analysis and TLC fingerprinting of methanolic extract of three medicinal plants. Int. Res. J. Pharm. 4(6). 123-126.

Ennaceur A, Delacour J (1988): A new one-trial test for neurobiological studies of memory in rats. Behavioural data. Behav. Brain Res. 31: 47-59.doi:10.1016/01664328(88)90157-X

Ennaceur A (2010): One-trial object recognition in rats and mice: methodological and theoretical issues. Behav Brain Res. 215: 244-254. doi: 10.1016/j.bbr.2009.12.036.

Ezeamuzie CI, Shihab PK (2010): Interactions between theophylline and salbutamol on cytokine release in human monocytes. J. Pharmacol. Exp. Ther. 334: 302–9. doi: 10.1124/jpet.109.163238.

Gaskin S, Tardif M, Cole E, Piterkin P, Kayello L, Mimby DG (2010): Object familiarization and novel-object preference in rats. Behav. Process. 2010(83): 61-71. doi: 10.1016/j.beproc.2009.10.003.

Horrigan LA, Kelly JP, Connor TJ (2006): Immunomodulatory effects of caffeine: friend or foe? Pharmacol. Ther., 111: 877–92. doi: 10.1016/j. pharmthera.2006.02.002.

Hsu KJ, Beard C, Rifkin L, Dillon DG, Pizzagalli DA, Bjorgvinsson T (2015): Transdiagnostic mechanisms in depression and anxiety: the role of rumination and attentional control. J. Affect. Disord. 188: 22-27. doi: 10.1016/j.jad.2015.08008.

Jäger AK, Saaby L (2011): Flavonoids and the CNS. *Molecules*. 16(2), 1471-1485. doi: 10.3390/molecules16021471.

Khan F, Magaji MG, Abdu-Aguye I, Hussaini IM, Hamza A, Olorukooba AB,

Sani MA, Maje IM. (2021): Phytochemical profiling of the bioactive principles of *Alysicarpus glumaceus* (Vahl) DC. aerial parts. Istanbul J. Pharm. 51(2), 228-238.

Khan F**,** Sani MA, Olorukooba AB, Abdu-Aguye I, Saratu D, Hussaini I (2022): A safety profile of aqueous methanol aerial extract of *Alysicarpus glumaceus* in mice: acute and subacute administration. J. Cur Biomed. Res**.** *2*(3, May-June), 224-243. doi: https://doi.org/10.54117/jcbr.v2i3.18.

Kiecolt-Glaser JK, Derry HM, Fagundes CP (2015). Inflammation: depression fans the flames and feasts on the heat. Am J Psychiatry. Nov 1;172(11):1075-91. doi: 10.1176/appi.ajp.2015.15020152.

Kruszka J, Martyński J, Szewczyk-Golec K, Woźniak A, Nuszkiewicz J (2025): The Role of Selected Flavonoids in Modulating Neuroinflammation in Alzheimer's Disease: Mechanisms and Therapeutic Potential. Brain Sci. 2022 May 5;15(5):485. doi: 10.3390/brainsci15050485. PMID: 40426656; PMCID: PMC12109823.

Kure C, Timmer J, Stough C (2017): The immunomodulatory effects of plant extracts and plant secondary metabolites on chronic neuroinflammation and cognitive aging: A mechanistic and empirical review. Front. Pharmacol. 8: 117. doi: 10.3389/fphar.2017.00117.

Lantz RC, Chen GJ, Sarihan M, Sólyom AM, Jolad SD, Timmermann BN (2007): The effect of extracts from ginger rhizome on inflammatory mediator production. Phytomedicine. 1. 123–8. doi: 10.1016/j.phymed.2006.03.003.

Liu Y, Ho RC, Mak A (2012): Interleukin (IL)-6, tumour necrosis factor alpha (TNF-alpha) and soluble interleukin-2 receptors (sIL-2R) are elevated in patients with major depressive disorder: A meta-analysis and meta-regression. J. Affect. Disord. 139(3): 230-239. doi: 10.1016/j.jad.2011.08.003

Maes M, Mihaylova I, Kubera M, Ringel K (2012): Activation of cell-mediated immunity in depression: Association with inflammation, melancholia, clinical staging and the fatigue and somatic symptom cluster of depression. Prog. Neuropsychopharmacol. Biol. Psychiatry. 36 (1). 169-75.

Martínez-Coria H, Arrieta-Cruz I, Gutiérrez-Juárez R, López-Valdés HE. (2023): Anti-Inflammatory Effects of Flavonoids in Common Neurological Disorders Associated with Aging. Int. J. Mol. Sci. 24(5):4297. https://doi.org/10.3390/ijms24054297.

Michel TM, Pulschen D, Thome J (2012): The role of oxidative stress in depressive disorders, Curr. Pharm. Des. 18(36). 5890–5899.

Middleton E (1998): Effect of plant flavonoids on immune and inflammatory cell function. Adv. Exp. Med. Biol. 439: 175–82. doi: 10.1007/978-1-4615-5335-9_13.

Morris HV, Dawson GR, Reynolds DS, Atack JR Stephens DN (2006): Both alpha 2 and alpha 3 GABA-A receptor subtypes mediate the anxiolytic properties of benzodiazepine site ligands in the conditioned emotional response paradigm. Eur. J. Neurosci*.,* 23. 2495-2504.

Nithya M. Sivakumar GM, Kiruthika G, Kokila A, Mohanasundaram A, Prasanna S, Rithikadevi N, Selvaraja V, Shibi SR, Thirisha T. (2025). Instrumental Approaches in Neuropharmacological Screening: A Review of Insights from Electroconvulsiometer and Actophotometer Studies, Int. J. of Pharm. Sci. Vol 3, Issue 8, 2670-2677. https://doi.org/10.5281/zenodo.16940508

Palta P, Samuel LJ, Miller ER, Szanton SL (2014): Depression and oxidative stress: results from a meta-analysis of

observational studies. Psychosom. Med. 76: 12–19

Parmar SK, Sharma TP, Airao VB, Bhatt R, Aghara R, Chavda S, Rabadiya SO, Gangwal AP (2013): Phytopharmacology, 4(2). 354-372.

Pathak G, Nigade A, Anitha K, Bhatt S (2025): Current drug targets for the treatment of depression. Brain Disord, 19, 100270. doi: 10.1016/j.dscb.2025.100270.
Pemminati S, Gopalakrishna H, Shenoy A, Sahu S, Mishra S, Meti V, Vinod N (2010): Antidepressant activity of aqueous of fruits of *Emblica officinalis* in mice. Int. J. Appl. Biol. Pharm. Technol. 1. 449-454.

Pfau ML, Menard C, Russo SJ (2018): Inflammatory mediators in mood disorders: therapeutic opportunities. Annu. Rev. Pharmacol. Toxicol. 58: 411-428. doi: 10.1146/annurev-pharmtox-010617-052823.

Phani GK, Anilakumar KR, Naveen S (2015): Phytochemicals having neuroprotective properties from dietary sources and medicinal herbs; Pharmacogn. J. 7(1). 1-17.

Phillips C, Fahimi A (2018): Immune and neuroprotective effects of physical activity on the brain in depression. Front. Neurosci. 12:498. doi: 10.3389/fnins.2018.00498

Ragavendran P, Sophia D, Raj CA, Gopalakrishnan, VK (2011): Functional group analysis of various extracts of *aerva lanata (l.,)* by FT-IR spectrum Pharmacologyonline. 1: 358-364.

Reis Ede M, Schreiner Neto FW, Cattani VB, Peroza LR, Busanello A, Leal CQ, Boligon AA, Lehmen TF, Libardoni M, Athayde ML, Fachinetto R. (2014): Antidepressant-like effect of Ilex paraguariensis in rats. Biomed Res Int.2014:958209. doi: 10.1155/2014/958209.

Rutten K, Reneerkens OA, Hamers H, Sik A, McGregor IS, Prickaerts J, Blokland A (2008): Automated scoring of novel object recognition in rats. J. Neurosci. Methods. 171(1). 72-77. doi: 10.1016/j.jneumeth.2008.02.006.

Sajid I, Bijan K, Zamiul R, Mominul I. Ekramul H (2013): CNS Depressant and Antinociceptive Activities of the Aerial Parts of *Mimosa pudica*. Eur. J. Appl. Sci. 5. 127-133.

Scott DA, Wright CE, Angus JA (2004): Evidence that CB-1 and CB-2 cannabinoid receptors mediate antinociception in neuropathic pain in the rat. *Pain.* 109. 124-131.

Sherman AD, Sacquitne JL, Petty F (1982): Specificity of the learned helplessness model of depression. Pharmacol. Biochem. Behav. 16:449e54.

World Health Organization –WHO (2025): Depressive disorder (depression). https://www.who.int/news-room/fact-sheets/details/depression (accessed 20/08/2026)

Yan S, You ZL, Zhao QY, Peng C, He G, Gou XJ, Lin B (2015): Antidepressant-like effects of Sanyuansan in the mouse forced swim test, tail suspension and chronic mild stress model. Kaohsiung J. Med. Sci. 31(12). 605-612.

Zhang Y, Jia X, Yang Y, Sun N, Shi S, Wang W (2024): Change in the global burden of depression from 1990–2019 and its prediction for 2030. J. Psychiatr. Res, 178. 16–22. https://doi.org/10.1016/j.jpsychires.2024.07.054.