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Evaluation of anxiolytic and antidepressant potential of hydroalcoholic extract of *Cordyline fruticosa* in mice

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Abstract
Anxiolytics and antidepressants are closely related because anxiety and depression often occur together and share similar brain pathways. Antidepressants reduce anxiety over time without the dependence risks associated with anxiolytics, making them the preferred long-term option, while anxiolytics are mainly used for acute or short-term symptom control. The use of medicinal plants in the treatment of mental diseases is a reality that has accompanied civilizations throughout history, and there are numerous species having pharmacologically confirmed central effects. Then, this study assessed the anxiolytic and antidepressant potential of the hydroalcoholic extract of *Cordyline fruticosa* (HECF) leaves in mice. *Cordyline fruticosa* significantly increased the proportion of entry into open arms at 200 mg/kg ($p < 0.01$), but not at 100 mg/kg, compared to the control group. The effects of different doses of hydroalcoholic extract of *Cordyline fruticosa* (HECF) on the entries into the close arms. Biostatic analysis revealed that *Cordyline fruticosa* significantly increased the immobility in both test (FST and TST) at 200 mg/kg ($p < 0.05$), but not at 100 mg/kg, compared to the control group. Based on the aforementioned findings, it was determined that *Cordyline fruticosa* hydro-alcoholic leaf extract possesses strong anxiolytic and depressive properties. When compared to control, both the 100 and 200 mg/kg dose levels of *Cordyline fruticosa* showed statistically significant anxiolytic and antidepressant effects in all parameters.

Keywords: Anxiolytic and antidepressant, *Cordyline fruticosa*

Introduction

Before 2020, mental disorders were leading causes of the global health-related burden, with depressive and anxiety disorders being leading contributors to this burden. The emergence of the COVID-19 pandemic has created an environment where many determinants of poor mental health are exacerbated. The need for up-to-date information on the mental health impacts of COVID-19 in a way that informs health system responses is imperative. In this study, we aimed to quantify the impact of the COVID-19 pandemic on the prevalence and burden of major depressive disorder and anxiety disorders globally in 2020. The Global Burden of Diseases (GBD), Injuries, and Risk Factors Study (GBD) 2019 showed that the two most disabling mental disorders were depressive and anxiety disorders, both ranked among the top 25 leading causes of burden worldwide in 2019. This burden was high across the entire lifespan, for both sexes, and across many locations. Perhaps more importantly, no reduction in the global prevalence or burden was detected for either disorder since 1990, despite compelling evidence of interventions that reduce their impact (COVID-19 Mental Disorders Collaborators, 2021) [2]

A group of conditions that can involve feelings of excessive worry, fear, nervousness, or dread. Anxiety can also cause irritability, stress that's out of proportion to the event, and an inability to set aside worries. Severe anxiety can lead to panic attacks, which can cause intense feelings of dread or panic, rapid breathing, sweating, shaking, and a feeling of impending doom. Anxiety is a natural emotional and physical response to stress or perceived danger, often accompanied by feelings of worry, fear, or unease. It can manifest in different forms, from mild unease to intense, debilitating fear (Halter, 2022) [9]. Symptoms may include restlessness, rapid heartbeat, shortness of breath, and muscle tension. A single illness that can cause feelings of sadness, hopelessness, despair, or reduced energy. Depression can also cause a loss of interest in activities, a significant change in appetite or weight, and sleeping too little or too much. Everyone feels sad or low sometimes, but these feelings usually pass with time. Depression (also called major depressive disorder or clinical depression) is different. It can cause severe symptoms that affect how you feel, think, and handle daily activities, such as sleeping, eating, or working. It is an illness that can affect anyone—regardless of age, race, income, culture, or education. Research suggests that genetic, biological, environmental, and psychological factors play a role in depression. Depression is one of the most common mental disorders in the India. Plants can help treat anxiety and depression through active compounds that affect neurotransmitters and brain function, though more research is needed to confirm their efficacy and safety for all conditions. Specific herbs like saffron, St. John's wort, lavender, and valerian have shown promise for mild to moderate depression, while others like Brahmi, Centella asiatica (Gotu Kola), and lemon balm may help with anxiety and stress relief. Plant secondary metabolites (phytochemicals) indicate potential for treating anxiety and depression by interacting with the same neurotransmitter systems (serotonergic, noradrenergic, dopaminergic, and GABAergic) and related pathways as conventional drugs. Their mechanisms involve interacting with neurotransmitter systems, primarily by enhancing the activity of inhibitory GABA receptors and boosting the levels of mood-regulating monoamines like serotonin and norepinephrine. Furthermore, these compounds help normalize the hypothalamic-pituitary-adrenal (HPA) axis, which reduces excessive stress hormone levels. Many secondary metabolites also exert potent anti-inflammatory and antioxidant effects, directly counteracting the chronic

inflammation and oxidative stress linked to mood disorders. Gut microbiota-derived metabolites, such as short-chain fatty acids, modulate the gut-brain axis by entering the bloodstream, reaching the brain, and regulating neuronal function and neuroinflammation. Lastly, a significant aspect of their action is enhancing neuroplasticity and neurogenesis by increasing brain-derived neurotrophic factor (BDNF) levels, which helps mitigate the neuronal damage caused by chronic stress. Thus, these diverse mechanisms collectively restore neurochemical balance and enhance neuronal resilience to mitigate symptoms of anxiety and depression. Several plant-derived secondary metabolites have demonstrated clinical efficacy in managing anxiety and depression symptoms, supported by various human trials. The most prominent examples include hyperforin and hypericin from St. John's wort (Hypericum perforatum), which numerous clinical studies find comparable in efficacy to conventional antidepressants for mild to moderate depression, although they pose significant drug interaction risks. Compounds like crocin and safranal found in saffron (Crocus sativus) have also shown effectiveness equivalent to synthetic antidepressants in treating mild to moderate depression and anxiety in randomized controlled trials (Phootha *et al*., 2022) [11].

For anxiety specifically, the terpene linalool, an active component of lavender (Lavandula angustifolia) oil, has been proven in clinical studies to significantly reduce generalized anxiety disorder symptoms. Similarly, the flavonoid apigenin in chamomile (Matricaria chamomilla) and kavalactones in kava (Piper methysticum) have clinical evidence supporting their use for reducing anxiety, though kava's use is often cautioned due to potential liver toxicity concerns. Lastly, the adaptogenic metabolites rosavin and salidroside in Rhodiola rosea have shown beneficial effects on mild to moderate depression and anxiety symptoms in various clinical settings. It is important for individuals to consult a healthcare professional before use, as these supplements can have significant interactions with conventional medications and are often not regulated by the FDA in the same manner as prescription drugs.

Materials and Methods

Analytical-grade chemicals were used throughout and Merck provided the ethanol (Germany). All research wer e conducted using deionized and milli-Q water. The leaves of *Cordyline fruticosa* were taken from the garden near Indore, M.P. The plants were authenticated, Botanist Dr. Sandeep K Verma and Voucher Specimen Number: J/Bot/SLF-049

Extraction

The fine, coarse powder was obtained from dried Leaves part of *Cordyline fruticosa* using an electric laboratory blender. Powder of *Cordyline fruticosa* was macerated in petroleum ether. Solid form of *Cordyline fruticosa* are kept in a stoppered container with the whole solvent and left to stand for at least 3 days (3–7 days) with regular agitation until soluble stuff is dissolved. After that whole material was undergo for filtration then remove the fatty filtrate and dried the solid none filtration part. These solid parts undergo for 2nd Cold maceration with ethanol and hot water in a 70:30 v/v ratio was used to complete the extraction. After fifteen days of combining the powdered material with the hydroalcoholic solvent, the mixture was separated via filter paper by Whatman after being mixed with the powdered material. In an electric oven set to 50 degrees Centigrade, the specimen was heated with a magnetic stirrer and boiled for a total of 45 minutes. The hydroalcoholic extract of *cordyline fruticosa* (HEFC) was cooled and collected in a well-closed container in the form of a dry state. (Fotsing Yannick Stéphane *et al*., 2022) [7]

Phytochemicals testing of the extract

The phytochemical analysis of the extracts was performed under the protocols that are conventional. A preliminary phytochemical screening was performed on both extracts to determine the different Phyto-constituents that were present in both of it. A big variety of natural resources compounds, including alkaloids and terpenoids as well as glycosides and steroids as well as flavonoids, saponin, and tannin, were examined. (Evans, 2009)

Acute toxicity studies

The Institutional Animal Ethical Committee (IAEC no-IAEC/SVCP/2025/FEB/04) endorsed the system. All creature research observed CPCSEA guidelines. Rodents had promotion limit um food and water (standard pellet). The exploratory work with the rodents started following a seven-day acclimation period. Each enclosure obliged two rodents, who were dispensed into two gatherings utilizing a randomized conveyance system. The treatment bunch got treatment (HEFC and standard), while the benchmark group got no treatment. Utilizing a 12-hour light/dull cycle, the rodents' lodging was kept at 24°C & 2°C (OECD, 2001). The "Fixed Dosage Method" of the OECD 423 guideline was utilised in the current investigation to determine the acute toxicity of the substance. The rats were given HEFC extract orally, and three albinos' female Wistar rats were chosen for each phase of the study. The rats were given dosages of Five mg, Fifty mg, three hundred mg, and two thousand mg by oral administration. It may take anyway HEFC from two to four phases before a conclusion can be reached on the toxic effect of the test substance and/or the morbidity condition of the animals. This will depend on the death rate [Alfredo *et al*., 2004]. The acute oral toxicity study of *Cordyline fruticosa* follows the OECD guideline 423. 20 Three female mice were randomly picked for each treatment. The animals were fasted for at least 4 hours and given unrestricted access to water. Mice were given an oral dosage of 5 mg/kg *Cordyline fruticosa* extract and monitored for toxic symptoms and fatalities during the first 4 hours and three days. If two out of three animals died, the treatment dose (5 mg/kg, p.o.) was considered harmful (Rameshwar *et al*., 2023) [12].

Study Design

For evaluating the Evaluation of anxiolytic potential *Hydroalcoholic extract of Cordyline fruticosa (HECF)*, 20 mice were divided randomly into four groups (Table -1) comprising of five animals in each group. First group served as a control that was treated with 10 ml/kg vehicle (0.5%w/v of carboxymethyl cellulose) by oral route. The second group considered as standard and that was treated with diazepam (1 mg/ kg, i.p.) The third and fourth groups considered as test groups and were treated with 100 or 200 mg/kg of potential *Hydroalcoholic extract of Cordyline fruticosa* (HECF).

Table 1: Grouping

S, no	Group	Treatment detail
1	Control (vehicle)	10 ml/kg vehicle (0.5%w/v of carboxymethyl cellulose
2	Standard	▪ Imipramine 20 mg/kg, p.o [For antidepressant activity] ▪ Diazepam (1 mg/ kg, i.p.) - [For anxiolytic activity]
3	Treatment group (Low dose-100)	Hydroalcoholic extract of *Cordyline fruticosa (HECF)* -100 mg/kg
4	Treatment group (High dose -200)	Hydroalcoholic extract of *Cordyline fruticosa (HECF)* -200 mg/kg

Evaluation of anti-anxiety activity (Thippeswamy *et al*., 2011) [16, 17]

a. Elevated plus maze test:

This consists of a central platform of 10 cm × 10 cm connected to two open arms of 50x10cms and two closed arms of 50 cm × 40 cm × 10 cm in dimension and elevated 50 cm above the floor. Swiss albino mice weighing 20-40 g was treated with hydroalcoholic extract of *Cordyline fruticosa (HECF)*, diazepam, and gum acacia 30 min before being placed individually in the center of the elevated plus maze, facing a closed arm. The time spent in both open and closed arms was recorded for 5 min. The time spent was measured in seconds. The numbers of entries into the open and closed arms were counted during the test. An entry was defined as having all four paws within the arm.

b. Light and dark exploration test:

The apparatus consisted of two square boxes separated by wooden wall each measuring 50 cm × 50 cm × 50 cm. One box was dark and another box illuminated with 7W/12V bulb. In the center of the wooden wall, there was an opening (6 cm × 6 cm) which can be opened or closed using a transparent plex glass sliding door from which the animals can move on either side. The mice were placed individually in the center of the light box and observed for the next 5 min. The time spent in both boxes was measured in seconds. The numbers of crossings between the boxes are also noted. The mice were treated with OS extract, diazepam, and gum acacia 30 min before being placed in the light box [Jain *et al*., 2003].

Evaluation of antidepressant activity (Yousuf *et al*., 2020) [18]

a. Forced swim test

For Forced Swim Test (FST) the method of [Can *et al*., 2012] was followed. It is the most widely used behavioural model for screening antidepressant-like activity in rodents. The experiment was carried out in two trials, the first trial lasts for 15 min, a second trial was performed after 24 h for 6 min. Animals were moved from the animal house to the laboratory and were allowed to acclimatize the conditions for 1-2 h. Each mouse was marked and forced to swim in an open glass chamber (25×15×25 cms) filled with water to a height of 15 cms. Water must be deep enough so that the animal cannot touch the bottom with feet/tail. Water was changed for each animal as used water is known to alter the behavioral pattern of the animals. The test was carried for a period of 6 min. The animals showed rapid movements in the water, trying to escape from the water for the first 2 min. The time of immobility was recorded during the next 4 min of the study.

b. Tail suspension test (TST)

For tail suspension test (TST) the technique of [Shinde *et al*., 2015] was followed. The test animals were moved from the animal house to the laboratory and were allowed to acclimatize for laboratory conditions for 1-2 h. Each mouse was suspended individually from the edge of the table 50 cms from the ground level with the help of an adhesive tape placed approximately 1 cm from the tip of the tail. Each animal was used only once in the test. The animal under study was acoustically and visually isolated from other animals during the test. The total period of immobility was recorded for 6 min. The animal was considered to be immobile when it did not show any movement, hung passively and remain completely motionless. The total time of immobility was recorded.

Result and Discussion

Hydroalcoholic extract of *Cordyline fruticosa* (HECF) is given below

Table 2: Phytochemicals testing of the extract

Carbohydrates	
▪ Molish examination	+
▪ Fehling's examination	+
▪ Bareford's examination	+
Alkaloids	
▪ Mayer's examination:	-
▪ Hager's examination	-
▪ Wagner's examination	-
Terpenoids	
▪ Salkowski examination	+
▪ Libermann Burchard's examination	+
Flavonoids	
▪ Lead Acetate examination	+
▪ Alkaline Reagent examination	+
▪ Shinoda examination	+
Tannins and phenolic compounds	
▪ $FeCl_3$ Solution examination	+
▪ Lead Acetate examination	+
▪ Gelatin examination	+
Saponins	
▪ Froth examination	-
▪ Sterol examination	-
Protein and Amino acids	+
▪ Ninhydrin examination	+
▪ Biuret's examination	+
Glycosides	
▪ Legal's examination	+
▪ Keller Killani examination	+
Fats and lipids	
▪ Spot examination	+

Toxicity testing was carried out on EEFC extract under OECD 423 criteria. Toxicological tests EEFC were supplied orally to the rats at doses ranging from 5 mg/kg to ranging

from 300-2000 mg/kg. The rats showed no preclinical symptoms of toxicity or mortality after being given the tests EEFC. All the animals gained weight and showed no signs of behavioural alteration, indicating that the administration on EEFC extracts had a minor effect on the animals' growth. LD50 values were shown to have concentrations of more than 2,000 mg/kg across all of the dosages tested and whole toxicity studies found that EEFC is no deaths or clinical symptoms of toxicity at any of the doses examined (Table-6.5).

When given to rats at a dosage of 2000 mg/kg, it has been shown that the extract EEFC are not deadly. As per guideline of OECD, a 1/10th dose of 200 mg/kg was chosen as the lower dose and 400 mg/kg as higher dose. The results of the observations are listed in the following table:

Table 3: Mortality at various doses in acute oral toxicity studies

S.no	Test Sample (mg/kg)	05	50	300	2000
1	EEFC	None	None	None	None

Cordyline fruticosa leaf extract was administered orally to mice at varying dosages until the maximum dose of 2000 mg/kg was reached, resulting in a 3-day mortality rate. There were no deaths involved till the highest dose of 2000 mg/kg. Minor toxicity symptoms at 2000 mg/kg included urine, stomach cramps, right leg elongation, abdominal distension, and muscular twitching. The extract dosages were set at 100 mg/kg and 200 mg/kg to allow for future pharmacological development.

- **Evaluation of anti-anxiety activity** the effects of different doses of hydroalcoholic extract of *Cordyline fruticosa* (HECF) on the into the open arms are shown in Fig. 1. A one-way analysis of variance revealed that, as compared to the control group, the *Cordyline fruticosa* extract increased the proportion of entry into the open arms. Biostatic analysis revealed that *Cordyline fruticosa* significantly increased the proportion of entry into open arms at 200 mg/kg ($p < 0.01$), but not at 100 mg/kg, compared to the control group. The effects of different doses of hydroalcoholic extract of *Cordyline fruticosa* (HECF) on the entries into the close arms are shown in Fig. 2. A one-way analysis of variance revealed that, as compared to the control group, the *Cordyline fruticosa* extract not increase the proportion of entry into the close arms. Biostatic analysis revealed that hydroalcoholic extract of *Cordyline fruticosa* (HECF) not significantly show difference compared to the control group.

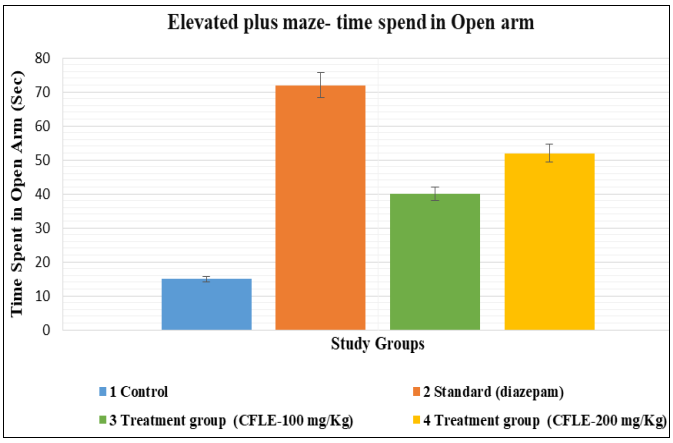
In an Elevated plus Maze (EPM), a head dip is a behaviour where a rodent partially lowers its head or the top half of its body below the edge of an open arm, often to peer down, and is a key indicator of anxiety-like behaviour, risk assessment, and exploration. An increase in head dips is generally interpreted as decreased anxiety, while fewer head dips can signify higher anxiety in a rodent. The effects of different doses of hydroalcoholic extract of *Cordyline fruticosa* (HECF) on the into the open arms are shown in Fig. 1. A one-way analysis of variance revealed that, as compared to the control group, the *Cordyline fruticosa* extract increased the Head dip into the open arms. Biostatic analysis revealed that *Cordyline fruticosa* significantly increased the proportion of Head dip into the open arms at 200 mg/kg ($p < 0.01$), but not at 100 mg/kg, ($P < 0.05$) compared to the control group.

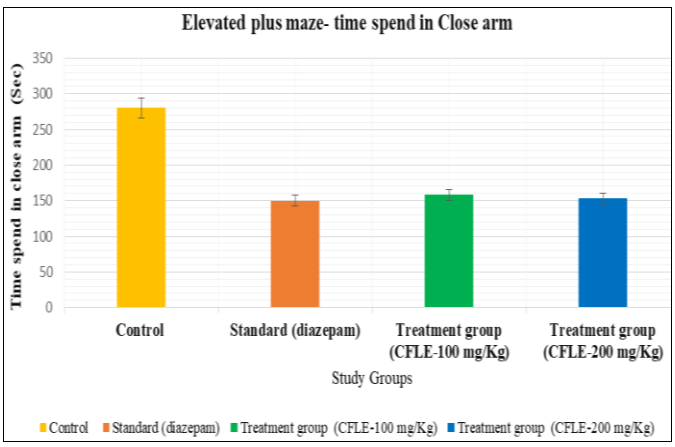
a. Elevated plus maze test

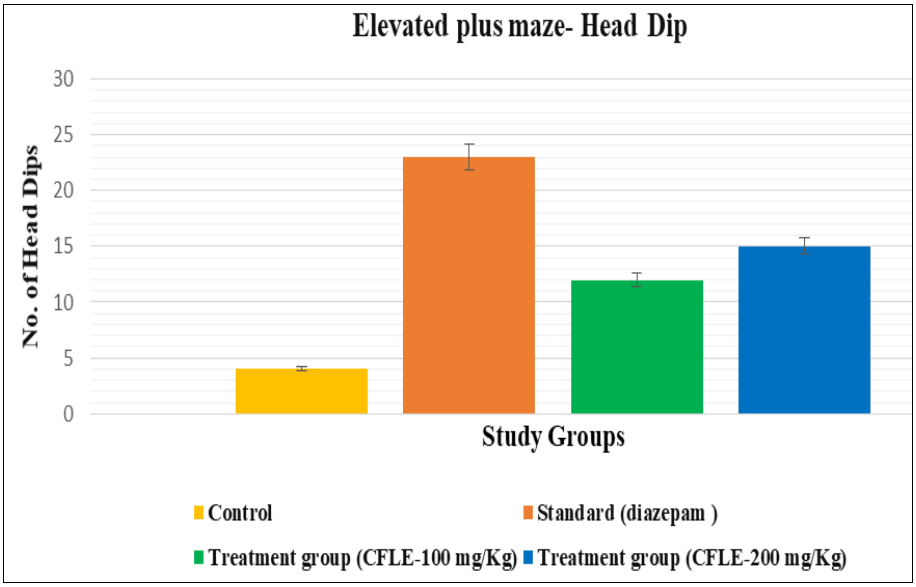
Tabe 4: Elevated plus maze test

S.no	Group	Time(S) spend in open arm Mean±SD	Time(S) spend in open arm Mean±SD	No. of Head Dips Mean±SD
1	Control	15 ± 1.3	280±2.1	4±1.1
2	Standard (diazepam)	72 ±.2.1**	150±2.9	23±2.6**
3	Treatment group (CFLE-100 mg/Kg)	40 ±1.5	158±3.2	12±2.4*
4	Treatment group (CFLE-200 mg/Kg)	52 ±1.8**	153±3.1	15±1.2**

Statistical significance was evaluated by one-way analysis of variance (ANOVA) and Bonferroni multiple pairwise comparisons between group means by Bio-stat 4.0 version Each Value represent in Mean±SD and n=5. Asterisk (*) is represent significant ($P<0.05$) and double asterisk, (**) High Significance ($p < 0.001$).





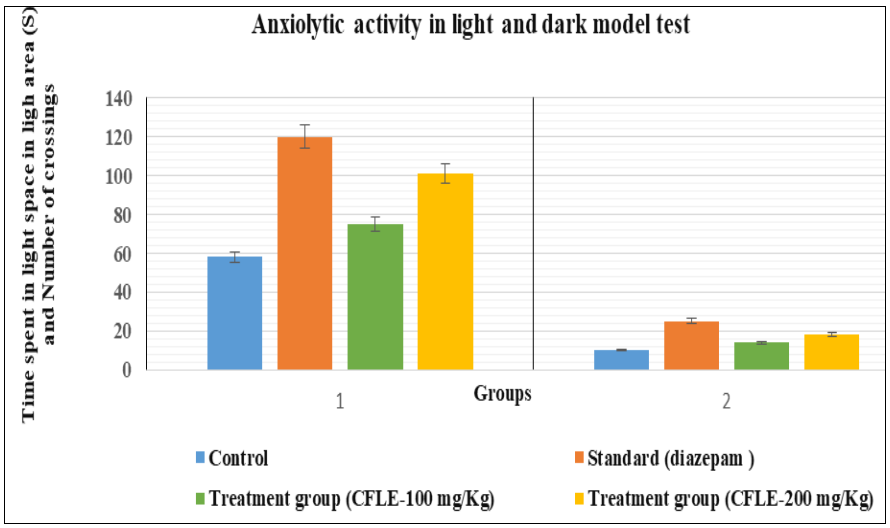


b. Light and Dark Box Model (LDB)

The Light-Dark Model (or Test) is a mouse behavioral test used to determine if a plant extract has anxiolytic (anti-anxiety) or anxiogenic (anxiety-causing) properties. Mice tend to avoid highly lighted locations, therefore anxiolytic-like substances will boost their exploration of the illuminated compartment, as assessed by time spent and transitions between compartments. Researchers give the plant extract and examine how the mouse's behavior in the light-dark box changes compared to the control groups to see if the extract has anti-anxiety qualities. The effects of different doses of hydroalcoholic extract of *Cordyline fruticosa* (HECF) on the into the time spent in light area and Number of crossings shown in Fig. 1. A one-way analysis of variance revealed that, as compared to the control group, the *Cordyline fruticosa* extract increased the Time spent in light area and Number of crossings at 200 mg/kg ($p < 0.01$), whereas 100 mg/kg, ($P < 0.05$) compared to the control group. Treatment with diazepam significantly increased the time spent ($P < 0.001$) in light box as well as the number of crossings ($P < 0.05$) between the light and dark boxes

Table 5: Light and Dark Box Model (LDB)

S.no	Groups	Time spent in light space	Number of crossings
1	Control	58 ±3.1	10 ±2.1
2	Standard (diazepam)	120±2.4**	25 ±2.9**
3	Treatment group (CFLE-100 mg/Kg)	75±2.9*	14±3.2*
4	Treatment group (CFLE-200 mg/Kg)	101±3.6**	18± 2.5**



Evaluation of antidepressant activity

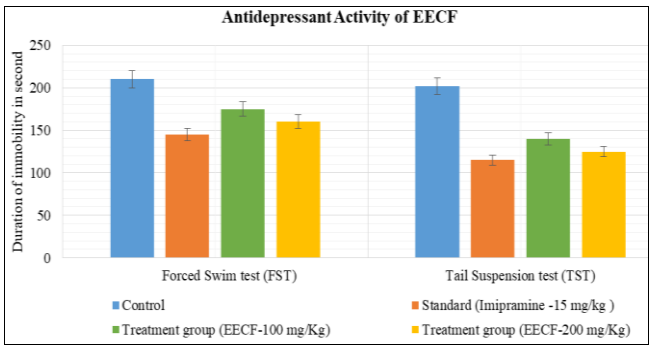
The forced swim test (FST) is a rodent behavioral test that uses a transparent, inescapable tank of water to measure a mouse's stress coping strategy, where increased immobility is interpreted as a depression-like behavior and can indicate an antidepressant effect. Mice are placed in a container of water and their escape-related mobility is measured, with the time spent immobile being the key

outcome. While popular for antidepressant screening and studying depression, the FST is now understood to measure stress coping more broadly and is not a definitive model for depression itself. The antidepressant activity of different doses of hydroalcoholic extract of *Cordyline fruticosa* (HECF) on the into the forced swim test (FST) and Tail Suspension test (TST) are shown in Fig. 6. A one-way analysis of variance revealed that, as compared to the control group, with standard increased the immobility in both the forced swim test (FST) and Tail Suspension test (TST) whereas Biostatic analysis revealed that *Cordyline fruticosa* significantly increased the immobility in both test (FST and TST) at 200 mg/kg ($p < 0.05$), but not at 100 mg/kg, compared to the control group.

Table 6: Antidepressant activity of hydroalcoholic xtract of *cordyline fruticosa* (HEFC)

S.no	Group	Forced Swim test (FST) Duration of immobility in second Mean ± SD	Tail Suspension test (TST) Duration of immobility in second Mean ± SD
1	Control	210 ± 4.18	202 ± 4.01
2	Standard (Imipramine -15 mg/kg)	145 ± 1.97**	115 ± 2.32**
3	Treatment group (HEFC-100 mg/Kg)	175 ±2.36	140 ± 3.21
4	Treatment group (HEFC-200 mg/Kg)	160 ± 3.21*	125 ±2.12*

Statistical significance was evaluated by one-way analysis of variance (ANOVA) and Bonferroni multiple pairwise comparisons between group means by Bio-stat 4.0 version Each Value represent in Mean±SD and n=5. Asterisk (*) is represent significant (P<0.05) and double asterisk, (**) High Significance ($p < 0.001$).



Plant secondary metabolites exhibit significant potential as natural agents for managing anxiety due to their diverse pharmacological properties. These bioactive compounds—such as flavonoids, alkaloids, terpenoids, phenolics, and saponins—modulate various neurobiological pathways associated with anxiety regulation. One of the primary mechanisms involves interaction with the GABAergic system, where compounds like flavonoids (e.g., apigenin and chrysin) enhance GABA receptor activity, producing a calming effect similar to benzodiazepines. Additionally, some metabolites influence the serotonergic system, which plays a key role in mood and emotional regulation; for example, terpenoids like linalool and limonene can modulate serotonin levels. Many secondary metabolites also act as antioxidants and anti-inflammatory agents, protecting neural tissue from oxidative stress and inflammation—factors known to contribute to anxiety disorders. Moreover, adaptogenic compounds such as withanolides (from Withania somnifera) and ginsenosides (from Panax ginseng) help normalize the hypothalamic-pituitary-adrenal (HPA) axis, reducing cortisol levels and enhancing the body's resilience to stress. Collectively, these mechanisms highlight the therapeutic potential of plant-derived secondary metabolites as safer, multi-targ*et al*ternatives for anxiety management.

Plant secondary metabolites play a significant role in exhibiting antidepressant activity through various biochemical pathways. Among the most notable are alkaloids, flavonoids, terpenoids, and phenolic compounds, which influence the central nervous system by modulating neurotransmitters such as serotonin, dopamine, and norepinephrine. For example, hypericin and hyperforin from *Hypericum perforatum* (St. John's Wort) are well-documented for their ability to inhibit the reuptake of key neurotransmitters, mimicking the action of conventional antidepressants. Similarly, flavonoids like quercetin and apigenin possess antioxidant and neuroprotective properties, reducing oxidative stress and enhancing mood regulation. Curcumin, a polyphenol from turmeric (*Curcuma longa*), has shown promise by increasing serotonin and dopamine levels while exerting anti-inflammatory effects. These natural compounds underline the potential of plant-based secondary metabolites as effective and safer alternatives in the treatment of depression.

The clinical effectiveness to anxiolytic agents or the opposite effects to anxiogenic agents, and the underlying cause for the response in these animal models are similar to that observed in humans. Both these models are known to induce anxiety in animals and are widely used for screening anxiety modulating drugs and for investigating the psychological and neurochemical basis of anxiety. Rodents have a natural aversion for open spaces and EPM model uses this conflict between exploration and aversion to open spaces. Apart from a novel environment, EPM also provides fear of height to the rodent. Anxiolytic agents such as BZPs (e.g., diazepam) suppress the aversive response to open spaces on EPM model. The LDT model, on the other hand, is based on the conflict between the tendency to explore a novel environment and aversion to open (potentially risky) and bright spaces. Similar to EPM model, treatment with anxiolytic drugs show increased exploration of the light box. In the present study, HECF showed significant anxiolytic activity in mice on the EPM and LDT model.

Depression is a heterogenous mood disorder characterized with regular negative moods, decreased physical activity, feelings of helplessness and is caused by decreased brain levels of monoamines like noradranline, dopamine and serotonin. Therefore, drugs restoring the reduced levels of these monoamines in the brain either by inhibiting monoamine oxidase or by inhibiting reuptake of these neurotransmitters might be fruitful in the treatment of depression that has been classified and treated in a verity of

ways. Although a number of synthetic drugs are being used as standard treatment for clinically depressed patients, they have adverse effects that can compromise the therapeutic treatment. Thus, it is worthwhile to look for antidepressants from plants with proven advantage and favourable benefits-to-risk ratio. In the present study, HECF showed less significant antidepressant activity (FST and TST) as compare to anxiolytic activity.

Conclusion

Based on the aforementioned findings, it was determined that *Cordyline fruticosa* hydro-alcoholic leaf extract possesses strong anxiolytic and depressive properties. When compared to control, both the 100 and 200 mg/kg dose levels of *Cordyline fruticosa* showed statistically significant anxiolytic and antidepressant effects in all parameters. Even though the exact mechanism underlying its anxiolytic and depressive properties is unknown, the observed activity can be attributed to plant components that share structural similarities with SSRIs. Therefore, more research is required to discover, isolate, and purify the active chemical ingredient in neem leaves that has the potential to be anxiolytic and antidepressant as well as to ascertain the mechanism of action. Furthermore, research is necessary to investigate its mode of action and the chemical ingredient that gives it its anxiolytic and depressive properties. These findings might lead to the development of new antidepressant and anxiolytic medications with reduced side effects and increased efficacy.

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