World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 7.409

EVALUATION OF ANTI DEPRESSANT ACTIVITY OF ETHANOLIC EXTRACT OF JACQUEMONTIA OVALIFOLIA ON EXPERIMENTAL MICE

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Article Received on 08/11/2024 **Article Revised on 28/11/2024** **Article Accepted on 18/12/2024**

ABSTRACT
Objective: – To study the anti-depressant activity of ethanolic extract of Jacquemontia Ovalifolia leaves using albino mice. **Method: –** The method was done on Swiss albino mice. The evaluation of the activity was done by forced swim test, Tail suspension test and Locomotor activity test. **Results:-** Treatment with ethanolic extract of Jacquemontia ovalifolia leaves at dose of 200 and 400 mg/ kg significantly showed therapeutic effects and as a potential natural remedy for managing depressive disorders. **Conclusion:-** The ethanolic extract of Jacquemontia ovalifolia leaves possess significant anti-depressant activity.

1. INTRODUCTION

1.1. Overview of depression

Depression, recognized as a mental disorder, induces persistent feelings of sadness, diminished energy, and a lack of interest in daily activities. Also referred to as major depressive disorder or clinical depression, it detrimentally impacts emotions, thoughts, behaviour, and can give rise to various emotional and physical challenges.

As per W.H.O depression stands as the second most common mental disorder globally, affecting an estimated 21% of the world's population. Its highest prevalence occurs among individuals aged 16-35 years. While depression can manifest at any time, it typically emerges during the late teens to mid20s. Women are more prone to experience depression than men, with studies indicating that about one third of women will undergo a major depressive episode in their lifetime. There is a substantial hereditary component, with approximately 40% heritability among first degree relatives who have experienced depression.

1.2. Types of depression

Major depressive disorder

It is the most prevalent form of depression, characterized by symptoms lasting for a few days to weeks.

Mood: Diminished enjoyment or decreased interest in daily activities, low mood, and sadness.

Sleep: Altered sleep patterns, either increased or decreased.

Behavioural: Aggressive tendencies, irritability, and social withdrawal.

Cognitive: Persistent anxiety, lack of concentration and confidence, recurring suicidal thoughts. Other Common **Features:** Fluctuations in weight, lower self-esteem, and changes in sexual activity.[1]

Bipolar disorder

This mental health condition entails severe mood swings, including manic episodes marked by heightened energy, impulsive behavior, rapid speech, decreased need for sleep., and euphoria. The contrasting side involves a profoundly depressed mood resembling major depression symptoms.

a. Psychotic depression

Individuals with psychotic depression exhibit major depression symptoms alongside psychotic manifestations like hallucinations, delusions, and unfounded paranoia, such as believing others intend harm.

b. Peripartum depression

Occurring before or after childbirth, peripartum depression results from hormonal fluctuations, sharing symptoms with major depressive disorder. Severe cases may hinder a parent's ability to care for their newborn, intensifying feelings of guilt and isolation.[2]

c. Situational depression

Commonly known as stress response syndrome, this type of depression is rooted in the life circumstances a person is facing, such as job loss, the death of loved ones, or health challenges.

d. Atypical depression

In this specific type, individuals may experience temporary happiness in response to environmental changes or positive events. Additional symptoms include increased appetite and an elevated mood.

1.3. Symptoms

During a depressive episode, individuals undergo a range of symptoms including a depressed mood, feelings of sadness or irritability, and a loss of interest in activities. Additional manifestations include:

- Emotions of sadness, tearfulness, emptiness, or hopelessness.
- Outbursts of anger, irritability, or frustration, even over minor issues.
- Diminished enjoyment or decreased interest in most or all usual activities.
- Sleep disturbances, encompassing insomnia or excessive sleeping.
- Fatigue and a lack of energy, making even small tasks challenging.
- Changes in appetite, leading to weight loss or gain.
- Heightened anxiety, restlessness, or agitation.
- Slowed thinking, speech, or body movements.
- Feelings of worthlessness or guilt, fixating on past failures or self-blame.
- Difficulty with thinking, concentrating, decision making, and memory.[3]
- Frequent thoughts of death, suicidal thoughts, attempts, or ideation.
- Unexplained physical issues such as pain in the back or headaches.

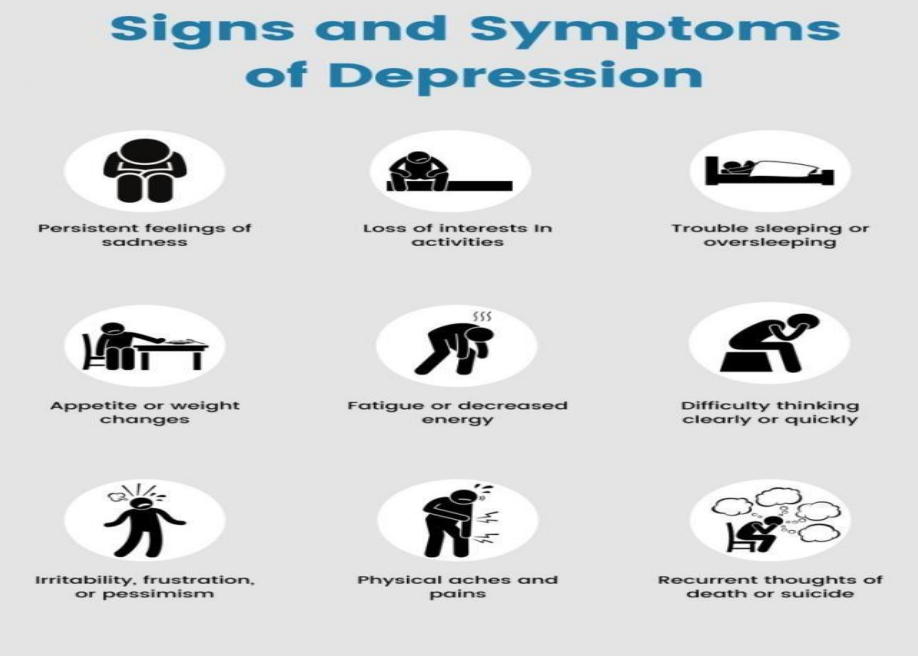


Fig. 1: Signs & Symptoms of depression.

1.4. Causes of depression

The precise cause of depression remains unknown, but several contributing factors include:

Abuse: Physical, sexual, or emotional abuse increases vulnerability to depression.[4]

Age: Elderly individuals face a higher risk of depression, exacerbated by factors like living alone and lacking social support.

Certain medications: Drugs such as isotretinoin (acne treatment), interferon alpha (antiviral), and corticosteroids can elevate the risk of depression.

Death or Loss: Grief following the death or loss of a loved one amplifies the likelihood of depression.

Gender: Women are approximately twice as likely as men to experience depression, possibly influenced by hormonal changes.

Genes: A familial history of depression heightens the risk, with depression considered a complex trait involving numerous genes exerting small effects.

Major events: Positive life events like job changes, graduations, or marriages can trigger depression, as can negative events like job loss, divorce, or retirement. However, clinical depression is more than a typical response to life stressors.

Other personal problems: Issues such as social isolation due to mental illnesses or exclusion from family or social groups contribute to the risk of clinical depression.

Serious Illnesses: Depression may cooccur with major illnesses or be prompted by other medical conditions.

Substance misuse: Nearly 30% of individuals with substance misuse problems also experience major or clinical depression. While drugs or alcohol may provide temporary relief, they ultimately exacerbate depression.[5]

1.5. Pathophysiology

In recent years, there has been a notable shift in

comprehending the physiopathology of depression. While the traditional monoamine hypothesis suggested a decrease in the function or quantity of monoamines (serotonin, dopamine, norepinephrine) as central to depression's biology, emerging evidence supports the significance of neurotrophic and endocrine factors, known as the neurotrophic hypothesis. Insights from examinations of tissue samples, studies involving the structural and functional imaging of the brain, and revelations in genetics., and steroid investigations collectively propose a multifaceted pathophysiology for depression.

1.5.1. Monoamine hypothesis

This theory posits that depression arises from an inadequate transmission of monoamines in the brain, namely serotonin, dopamine, and norepinephrine.[6] The functional deficit in amine transmission is thought to contribute to the development of depression. Medications enhancing amine function in brain synaptosomes, such as tricyclic antidepressants, monoamine oxidase inhibitors, and selective serotonin reuptake inhibitors, have been utilized effectively in treating depression by augmenting aminergic transmission directly or indirectly.

1.5.2. Neuroendocrine dysregulation theory

Depression is associated with hormonal irregularities, particularly within the hypothalamic pituitary adrenal (HPA) axis. Major Depressive Disorder correlates with heightened cortisol levels, no suppression of adrenocorticotropic hormone (ACTH), and persistently elevated corticotropin releasing hormone. More severe depression forms, like psychotic depression, often exhibit abnormalities in the HPA axis. Both exogenous glucocorticoids and endogenous cortisol elevation mimic mood symptoms observed in depression. Additionally, thyroid dysregulation is noted in up to 25% of depressed patients, with clinical hypothyroidism presenting depressive symptoms that improve with thyroid hormone supplementation. Thyroid hormones are employed alongside standard antidepressants for therapeutic enhancement.

1.5.3. Neurotrophic hypothesis

The neurotrophic hypothesis centres on the role of nerve growth factors, particularly brain derived neurotrophic factor (BDNF), in regulating neural plasticity, resilience, and neurogenesis. Depression is linked to a insufficiency in neurotrophic support, resulting in structural changes in brain regions like the hippocampus, anterior cingulate, and medial orbital frontal cortex. Pain and stress are associated with decreased BDNF levels, contributing to atrophic changes. Structural imaging studies reveal a 5–10% volume loss in the hippocampus during major depression. BDNF's impact on emotional regulation is underscored, with direct infusion showing antidepressant like effects in animals model. Antidepressants, electroconvulsive therapy, and other interventions elevate BDNF levels and promote hippocampal neurogenesis. Ongoing research into this hypothesis holds promise for uncovering insights and potential treatment targets for depression.

1.6. Treatment of depression

Non-Pharmacological approaches: These non-pharmacological interventions offer diverse options for managing depression and improving overall mental wellbeing.

1.6.1. Herbal supplements

Herbal remedies, with a historical usage for treating various ailments, are increasingly popular as a natural alternative to SSRIs, boasting fewer side effects. Notable herbal options include:

Curcumin: Derived from turmeric, a widely used spice in India, curcumin is welltolerated and can serve as a supplement for managing depression, particularly in patients without suicidal ideation.

- **Saffron:** Another commonly used spice in India, saffron, has demonstrated natural antidepressant properties in studies. Research suggests its effectiveness is comparable to fluoxetine.
- **ST. John's wort:** Traditionally used in Europe for centuries to treat depression, St. John's Wort, or Hypericum perforatum, is not FDA approved due to potential side effects like confusion, muscle stiffness, and psychosis. It may be considered for treating mild depression in select patients.[7]

1.6.2. Meditation and Yoga

Engaging in regular meditation (3040 minutes) provides active training to relax the body and enhance cognition, effectively reducing symptoms of anxiety and depression. Daily yoga practice, involving breath control and various poses, has proven effective in alleviating anxiety and depression.

1.6.3. Exercise

Daily physical exercise not only diminishes depression but also reduces stress, promotes relaxation, enhances heart health, lowers blood pressure and cholesterol, and normalizes sleep patterns. Incorporating stretching exercises has shown to improve mental health by elevating serotonin levels in the brain.

1.6.4. Psychotherapy

Also known as talk therapy or psychological therapy, psychotherapy involves conversations between a therapist and a patient about their health condition and related issues. The therapist provides beneficial suggestions and advice to improve mental health.

1.6.5. Electroconvulsive Therapy (ECT)

ECT is administered to patients who do not respond adequately to medications and have a heightened risk of suicide. This therapy involves passing electrical currents through the brain to enhance neurotransmitter function, alleviating depression.

1.6.6. Transcranial Magnetic Stimulation (TMS)

TMS is employed when patients do not respond positively to medication and exhibit a high suicidal risk. In this therapy, a treatment coil is placed against the patient's scalp, sending brief magnetic pulses to stimulate nerve cells in the brain. This helps regulate mood and reduce depression.

1.6.7. Additional methods

Various methods for relieving mild or basic depression include listening to calming music, massage therapy, acupuncture, aerobic exercise, and maintaining a healthy diet.

Pharmacological treatment

Antidepressants: A class of drugs used to treat or prevent depression, encompass various types such as MAO reuptake inhibitors, selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants, and atypical antidepressants.

1.7. Calssifictaion of antidepressants

1.7.1. Selective Serotonin Reuptake Inhibitors (SSRIs)

SSRIs, the preferred first line drugs for treating mild to moderate depression, operate by inhibiting selective serotonin reuptake, thereby increasing its concentration to enhance neurotransmission and alleviate depression. Well tolerated with lower toxicity, caution is advised against administering SSRIs to bipolar depressive patients due to the potential induction of hypomania. Additionally, they may be ineffective for severe depressive patients.

1.7.2. Tricyclic antidepressants

Despite being among the most effective depression treatment options, tricyclic antidepressants are not the first choice due to adverse effects. They are reserved for acute and maintenance treatment of depression. Acting by inhibiting the neuronal reuptake of monoamines, they elevate concentration, enhancing neurotransmission and reducing depression. There are NE & SHT reuptake inhibitors that act on noradrenaline and serotonin, increasing their concentration to alleviate depression.

1.7.3. Mao inhibitors

MAO inhibitors induce the inhibition of monoamines, leading to an increased concentration of serotonin and norepinephrine in the brain, resulting in an antidepressant effect. Irreversible (nonselective) MAO inhibitors act by irreversibly inhibiting both MAOA and MAOB, while reversible (selective) MAOA inhibitors selectively and reversibly inhibit MAOA, both contributing to heightened neurotransmission and reduced depression.[8]

1.7.4. Atypical antidepressants

Considered the preferred and first line drugs for treating depression due to their favourable tolerability and increased efficacy. Atypical antidepressants act by inhibiting αadrenergic receptors and inhibiting the reuptake of serotonin and norepinephrine, leading to an increased concentration and mitigating the effects of depression.

In summary, antidepressants offer diverse mechanisms to address depression, with each class playing a specific role in modulating neurotransmitter levels to alleviate symptoms.[9]

2. Review of literature

Jacquemontia ovalifolia

2.1. Plant name: Jacquemontia ovalifolia

Family: Convolvulaceae

Synonyms: Jacquemontia violacea, Jacquemontia pentanthos, Choisy

2.2. Vernacular names

English names: Sky blue cluster vine, Jacquemontia creeper.

2.3. Plant description

Jacquemontia ovalifolia belongs to Convolvulaceae family and is commonly referred to as the morning glory family, and is indigenous to the southeastern coastal area of Florida. Also known as cluster vine, this perennial plant possesses a woody base and has the potential to adopt a shrubby growth form. It primarily thrives in sandy littoral beachfront and maritime hammock environments.[10] The plant blooms from September to June, with vining upper stems adorned with relatively tomentose leaves.[11] Its flowers are bell or wheel-shaped, ranging from blue to white, with a relatively short corolla tube.[12]

Distribution: *Jacquemontia ovalifolia* is native to Brazil northeast, central African, Columbia, Georgia, Mexico, India, Kenya, Virginia, Zimbabwe.

Habitat: Beach coastal strand and maritime hammock.

2.4. Morphology of the plant

Jacquemontia is a perennial vine which has a main stem with numerous laterals spreading out from a stout rootstock.

Flowers The flowers of *Jacquemontia ovalifolia* are typically white to light pink, and the sepals exhibit persistence. These trumpet-shaped flowers of the Blue Cluster vine, measuring approximately 0.5 inches across when open in the morning and closing by mid-afternoon, are characterized by five petals and a central portion that can be white or yellow. The plant produces an abundance of blue flowers, making it well-suited for covering trellises and thriving in pots, especially when the creeper displays its beauty with numerous flowers after rains and during the cooler season.

The **fruit** is a light brown. Fruit is a small round capsule with seeds. Each fruit contains four seeds.[] The plant requires open areas like those found behind stable sand

dunes. The **stem** of the creeper is slender and green. They are usually green orreddish-brown in colour and have a slightly hairy or pubescent texture. *Jacquemontia ovalifolia* is a type of vine, and a single plant can produce multiple green shoots, known as laterals, which extend from the main stem of the plant.[38] It can be grown in big pots/containers.

The **leaves** are small, shiny, and heart-shaped with pointed tip and are arranged alternatively. The vine produces fresh leaves up to 3 centimeters long and circular bluish flowers. It grows in sunny area and is useful for balconies, terraces, and gardens. Year- around flowering, flowers in flushes throughout the year. Attracts butterflies and bees. A quick growing climber is popular for its ever-present blooms. It can be grown for its beautiful appearance. A quick growing climber is popular for its ever-present blooms.[13]

Maximum height: Its growth is around 6 to 8 meters in height.
Blooming year: It blooms year-round with profuse flowering.
Growing: This climbing plant, regarded as one of the finest flowering climbers, is uitable for growing on porches, arches, pergolas, and walls. It flourishes and blooms best when exposed to full sun, adapting well to mild climates and thriving in partial shade in hot and arid regions. Planting in fertile, well-drained soil is recommended. After the blooms conclude, it is advisable to thoroughly clean dry shoots. If planted alongside a fence, maintaining a distance of 3 to 4 feet between plants is recommended, while as a ground cover, a distance of 60 cm is suitable.[] This long-lived climber necessitates sturdy and permanent supports, and pruning can be carried out to maintain the desired shape.

It requires a minimum of more than 4 hours of direct sunlight, and planting in full shade may reduce the frequency of flowering. Watering is advised when the top 2-3 inches of soil feels dry to the touch, and moisture should be consistently maintained near the root zone. The soil should be well-drained, fertile, and rich in organic content.[43] With an average temperature range of 25– 35 degrees Celsius, applying organic fertilizer once a month contributes to the plant's overall health, and water should be applied immediately after fertilizer application. For more vigorous flowering, a phosphorus-based fertilizer can be beneficial.[15]

Fig. 2: Jacquemontia ovalifolia.

2.5. Taxonomical classification

Jacquemontia ovalifolia belongs to the Convolvulaceae family, which is known as the morning glory family.[]
Kingdom: plantae Phylum: Tracheophyta Class: Magnoliopsida Order: Solanales Family: Convolvulacea Genus: Jacquemontia Species: ovalifolia.[15]

2.6. Chemical constituents

The core foundation for the therapeutic effectiveness of plants lies in the phytochemicals they contain and their antioxidative capacities. Comprehensive phytochemical analyses on diverse components of the *Jacquemontia ovalifolia* plant have revealed the existence of a range of phytoconstituents and compounds, encompassing alkaloids, flavonoids, and saponins. These substances serve as secondary metabolites and also function as defense mechanisms. Flavonoids dissolve the extracellular proteins and form protein complexes. Alkaloids possess antibacterial, antioxidants, antifungal, analgesic, anxiolytic, anticoagulant and anticancer activities.[17]

2.7. Chemical components found in various sections of the plant

Leaves: Plant leaves often contain a variety of secondary metabolites, including flavonoids, alkaloids, terpenoids, and phenolic compounds. These compounds contribute to the plant's defense mechanisms, pigmentation, and interactions with other organisms.
Flowers: Flowers are known to contain a wide range of compounds, including pigments, essential oils, flavonoids, and volatile organic compounds (VOCs). These compounds contribute to the fragrance, color, and attraction that attract pollinators.
Stems: Stems of plants can contain various compounds such as lignin, cellulose, and hemicellulose, which provide structural support. They may also contain secondary metabolites, especially in medicinal plants, for

their protective properties.

Roots: The roots commonly possess various secondary metabolites such as alkaloids, glycosides, tannins, and essential oils. These compounds can have antimicrobial, antioxidant, and other biological activities.

Seeds: Plant seeds typically contain storage compounds such as proteins, carbohydrates, and oils. Additionally, some seeds contain alkaloids or other compounds that deter herbivores and pathogens.[16]

2.8. Traditional uses of Jacquemontia ovalifolia

- The juice extracted from the leaves and roots is consumed as a remedy to treat bites of green mamba snakes and leaf infusion is used to wash wounds.
- Fruit decoction of this species can be used to treat cough and fevers and thestem is utilized in the management of constipation, flatulence, liver complaints.
- Seeds of this family have carminative and purgative properties.
- *Jacquemontia ovalifolia* has been used topically in traditional medicine to address various skin conditions. It is often applied as a poultice or used in creams or ointments to treat rashes, insect bites, and skin irritations.[18]
- *Jacquemontia ovalifolia* has been used to support women's health. It is sometimes used to alleviate menstrual discomfort, regulate menstrual cycles, or promote lactation in breastfeeding women.
- It may be consumed as a tea or used in steam inhalations.
- It is often applied as a poultice or used in creams or ointments to treat rashes, insect bites, and skin irritations.
- *Jacquemontia ovalifolia* has been employed in traditional remedies to control elevated blood pressure and support cardiovascular well-being.

2.9. Pharmacological uses of jacquemontia ovalifolia

- **Anti-inflammatory activity**

Certain studies have indicated the potential anti-inflammatory properties of *Jacquemontia ovalifolia* extracts. These properties could be linked to the existence of bioactive compounds like flavonoids and phenolic compounds.[19]

- **Anti-microbial activity**

Several investigations have indicated that extracts derived from *Jacquemontia ovalifolia* exhibit antimicrobial characteristics against specific strains of bacteria and fungi. These antimicrobial properties could prove valuable in the creation of natural antimicrobial agents.[49]

- **Antioxidant activity**

Extracts from *Jacquemontia ovalifolia* have shown antioxidant potential. Antioxidants play a crucial role in counteracting detrimental free radicals within the body, providing protection against oxidative stress, a condition linked to numerous diseases.

- **Anti-fungal activity**
- **Analgesic**
- **Anxiolytic**
- **Anti-coagulant**

2.10. Review of literature on previous study

1) Anti Bacterial activity of Jacquemontia ovalifolia

Asma naaz, Zeba Tabassum, Syed Rehan, Sufiyan Mohd Perwez, Syed Haseeb Ul Haq.

The research aimed to assess the antibacterial properties of Jacquemontia ovalifolia against both gram-positive (Staphylococcus aureus) and gram-negative bacteria (Escherichia coli, Pseudomonas aeruginosa, Proteus mirabilis, and Vibrio cholera). Various plant extracts were tested at different concentrations (5, 10, 15, 20 µg/ml) using the disc diffusion method. Phytochemical analysis revealed the presence of alkaloids, flavonoids, glycosides, saponins, tannins, and triterpenes in the extracts. The results demonstrated significant antibacterial activity, with the methanolic extract exhibiting the maximum zone of inhibition at a concentration of 20 µg/ml against Staphylococcus aureus. The observed antibacterial effects are attributed to the presence of these identified secondary metabolites.[20]

2.11. Taxonomical Study of Jacquemontia ovalifolia (Convolvulaceae)

D.Štajner, N. Milić, B. Lazić, N. Mimica-Dukić.

Jacquemontia ovalifolia (Choisy) Hallier f. stands out as one of the widely distributed species within its genus. An examination of herbarium specimens across its geographic range led to the identification of three subspecies: subsp. ovalifolia in Africa, subsp. obcordata (Millspaugh) Robertson in Mexico and the West Indies, and subsp. sandwicensis (A. Gray) Robertson in the Hawaiian Islands. Although the species likely originated in the Americas, it was dispersed to Africa and Hawaii by unknown means and at an undetermined time. The taxonomic and nomenclatural histories of both the species and its subspecies have been thoroughly reviewed, and a comprehensive taxonomic treatment is provided. During the revision of the New World species of Jacquemontia Choisy, challenges arose in dealing with J. subsalina Britton or J. obcordata (Millspaugh) House. It became evident that resolving these issues required a global study of this taxon and its relatives across Africa, Mexico, the West Indies, and the Hawaiian Islands.[21]

2.12. Literature review of Anti- Depressant activity

1) Antidepressant activity of aqueous extracts of curcuma longa in mice

Z.F Yu, **L.D Kong**, **Y Chen (2002)**. Curcuma longa, commonly known as turmeric, is a widely recognized indigenous herbal remedy. When orally administered to mice at doses ranging from 140 to 560 mg/kg over a 14day period, aqueous extracts exhibited a dose

dependent reduction in immobility in both the tail suspension test and the forced swimming test. The effects of the extracts at the 560 mg/kg dose were more potent than the reference antidepressant fluoxetine. Extracts at doses of 140 mg/kg or higher for 14 days significantly inhibited monoamine oxidase A (MAOA) activity in the whole mouse brain in a dose dependent manner. Notably, oral administration of the extract at only the 560 mg/kg dose demonstrated observable MAOB inhibitory activity in the animal brain. In comparison, fluoxetine exhibited a tendency to inhibit both MAOA and MAOB activity in the animal brain. Neither the extracts of C. longa nor fluoxetine, at the doses tested, had significant effects on locomotor activity. These findings indicate that C. longa specifically possesses antidepressant.[22]

2) Antidepressant activity of asparagus racemosus in rodent models

K. Singh, **Debapriya Garabadu, A. V. Muruganandam**, **K. Joshi**, **Sairam Krishnamurthy (20 09).** This study assesses the antidepressant properties of the methanolic extract from the roots of asparagus racemosus (MAR), standardized to saponins (62.2% w/w). Rats were administered MAR at doses of 100, 200, and 400 mg/kg daily for 7 days, followed by evaluation using the forced swim test (FST) and learned helplessness test (LH). The findings indicate that MAR reduces immobility in FST and enhances avoidance responses in LH, signifying antidepressant activity. In behavioral experiments, MAR increased the number of head twitches induced by 5HTP and promoted clonidine induced aggressive behavior, indicating a facilitating effect on both the serotonergic and adrenergic systems, respectively. However, MAR had no significant impact on LDOPA induced aggressive behavior, suggesting an absence of activity on the dopaminergic system. Additionally, MAR reversed alterations to the endogenous antioxidant system induced by FST. In conclusion, MAR demonstrates notable antidepressant activity, likely mediated through the serotonergic and noradrenergic systems, along with augmentation of antioxidant defense.[23]

3) Evaluation of anti-depressant and anxiolytic activity of fruit extract of hylocereus undatus in experimental animals

Supriya S. Walvekar, Nilofar S. Naikwade, Shirish S. Patil, Ayesha K. Mulla, Pooja N. Khot (2022). The current research utilized Hylocereus undatus, commonly known as dragon fruit, to explore its antidepressant and antianxiety properties. In the antidepressant assessment, the administration of 200 mg/kg and 400 mg/kg ethanolic fruit extract of H. undatus (EFEHU), along with the standard drug imipramine (20 mg/kg) for 21 days to their respective animal groups markedly decreased the duration of immobility. in both tail suspension test (TST) and despair swim test (DST) in a dose dependent manner. Biochemical estimations were also conducted. For the anxiolytic evaluation, the administration of 200 mg/kg and 400 mg/kg EFEHU, along with the drug diazepam (2 mg/kg) for 14 days to their respective animal groups, significantly increased the time spent in the open arm and the number of entries in the open arm in the Elevated Plus Maze test (EPMT). There was a significant boost in the levels of 5HT and GABA in the mice brain in a dose dependent manner in both DST and EPMT. Phytochemical analysis of EFEHU revealed the presence of alkaloids, tannins, carbohydrates, flavonoids, terpenoids, saponins, oils, phenolic compounds, and qualitative examination using HPTLC indicated the presence of quercetin and gallic acid. Therefore, the identified compounds in the extract are likely responsible for the observed antidepressant and anxiolytic activities.[24]

4) Antidepressant activity of methanolic extract of verbena officinalis linn. plant in mice

Talha Jawaid, Syed aman imam, Mehnaz kamal (2015). The aim of this study was to explore the anti-depressant potential of the methanolic extract derived from the leaves of Verbena officinalis Linn. (MEVO) in mice. The investigation involved assessing the anti-depressant activity of MEVO in mice through tail suspension test (TST) and forced swimming test (FST). Additionally, the impact of MEVO on spontaneous locomotor activity (SLMA) was examined in mice. Over seven consecutive days, MEVO was orally administered at doses of 100 mg/kg and 200 mg/kg in separate groups of Swiss mice for the TST, FST, and SLMA. The results revealed that the extract, at both 100 mg/kg and 200 mg/kg doses, markedly decreased the duration of immobility. In mice in a dose dependent manner during both the tail suspension and forced swim tests, comparable to the effects observed in the control group. These findings indicate that MEVO possesses specific antidepressant effects. This study suggests that MEVO holds potential antidepressant properties, making it a canddate of therapeutic interest for treating individuals with depression.[25]

3. AIM AND OBJECTIVES

Aim

The aim of the study was to evaluate the antidepressant activity of ethanolic extract of leaves of *Jacquemontia ovalifolia* in albino mice.

Objectives

Depression is the second leading psychiatric disorder with an estimate of 21% of the world population suffering from this illness. While several synthetic medications are employed as conventional treatments for individuals with depression, they have demonstrated a range of undesirable effects, including insomnia, dizziness, anxiety, weight gain, and gastrointestinal disorders that can compromise the therapeutic treatment.

Several medicinal plants and medications derived from them have exhibited antidepressant properties. Thus, it is

worthwhile to look for an antidepressant derived from medicinal plants with favourable benefit to risk ratio.

Plan of work

- Collection and authentication of *Jacquemontia ovalifolia* plant.
- Preparation of *Jacquemontia ovalifolia* ethanolic extract of *Jacquemontia ovalifolia.*
- Phytochemical screening of the ethanolic extract of *Jacquemontia ovalifolia.*
- Acutetoxicity study of ethanolic extract of *Jacquemontia ovalifolia.*
- Evaluation of ethanolic extract of *Jacquemontia ovalifolia* Antidepressant activity in Albino mice.
- Statistical Analysis of data by graphpad prism 10.03 version.

4. MATERIALS AND METHODS

4.1. Plant material

Jacquemontia ovalifolia fresh plant was collected from the Botanical Garden nd authenticated by Dr K Madhavachetty Professor Dept of Botony, Sri Venkateswara University, Tirupathi, A.P, India. The freshly collected aerial part of plant will be thoroughly washed thrice in distilled water; shade dried, cut into fine pieces and powered using a mechanical blender. The powdered material will be passed through 80 mesh sieve and extracted with ethanol using Soxhlet's apparatus. The extract obtained will be dried in rotary vacuum evaporator at 400 °C yielding a yellowish green coloured viscous mass.[26]

4.2. Drugs and Chemicals

The chemicals employed in this research were of analytical grade. Fluoxetine, utilized as the standard drug in this investigation, was obtained from Shadan Hospital.

Fig. 3: Fluoxetine 20mg.

4.3. Animals used

Swiss albino mice, 3–4 weeks of age, weighing between 20 and 25 g, were used in this study. These mice were collected from Centralised experimental Animal Divison, Shadan Institute of Medical Sciences, Hyderabad. Animals were kept in polyvinyl cages with soft wood bedding materials. Animals were well maintained under standard environmental conditions (temperature: 25 ± 2 °C, relative humidity: 55–65% and 12 h light/dark cycle). The animals were habituated to the laboratory environment for a period of 14 days prior to performing the experiments. Experimental Protocol was approved by The Institutional Animal Ethical Committee of shadan institute of medical sciences, Hyderabad. CPCSEA Reg No:- 1864/PO/Re/16/CPCSEA.

Fig:- Experimental Mice (Albino mice).

4.3.1. Approval from animals ethics committee

The study was performed after getting approval from Animals Ethics Committee of Shadan institute of medical sciences, Hyderabad. Ref. No. IAEC-02/SES/2024/B-Ph-03.

4.4. METHODOLOGY

4.4.1. Preparation of plant extract

The freshly collected aerial part of plant will be thoroughly washed thrice in distilled water, shade dried, cut into fine pieces and powered using a mechanical blender. The powdered material will be passed through 80 mesh sieve and extracted with ethanol using Soxhlet's apparatus. The extract obtained will be dried in rotary vacuum evaporator at 400 °C yielding a yellowish green coloured viscous mass.[27]

4.4.2. Preliminary phytochemical screening

Preliminary phytochemical screening was conducted on Aerva Lanata to identify the presence of different groups of phytoconstituents. This involved performing specific identification tests for alkaloids, flavonoids, carbohydrates, proteins, tannins, saponins etc.

4.4.3. Alkaloids testing

Wagner's test: Add Wagner's reagent to 2 to 3 ml of the test solution; the formation of a reddishtobrown precipitate confirms the presence of alkaloids.

Mayer's test: Introduce Mayer's reagent to 1 ml of the test solution, observing the formation of a white or creamy precipitate.

Tannic acid test: Combine 2 ml of the test solution with tannic acid, resulting in the formation of a bufftocolored precipitate.

Picrolonic acid test: Add 1 to 2 ml of picrolonic acid to 2 to 3 ml of the test solution, leading to the appearance of a yellow precipitate.[28]

4.4.4. Flavonoids testing

Pew's tests: Mix zinc powder with 2 to 3 ml of the test solution, followed by the dropwise addition of concentrated HCl; the presence of flavonoids is confirmed by a purple to red or cherry color.

Shinoda tests: Add t-tobutyl alcohol and magnesium turnings to 2 to 3 ml of the test solution, then slowly add concentrated HCl, resulting in the formation of a magenta color.

NaOH tests: Introduce NaOH solution to 2 to 3 ml of the test solution; the development of a yellow color that disappears upon the addition of dilute HCl signifies the existence of flavonoids.

4.4.5. Tannins and phenolic compounds testing

FeCl3 test: Add FeCl3 solution to 2 ml of the test solution; the development of a deep blue to black color signals the presence of compounds.

Lead acetate test: Introduce lead acetate solution to 2 to 3 ml of the test solution; the appearance of a white precipitate signifies the existence of. Compounds.

Gelatin test: Add gelatin solution to 2 to 3 ml of the test solution; the formation of a white precipitate signifies the existence of. compounds.

4.4.6. Glycosides testing

Keller killiani test: Combine 2 ml of the test solution with glacial acetic acid, 5% FeCl3, and conc. H2SO4; the appearance of a reddish to brown color at the liquid layers' junction signifies the existence of. glycosides.

Haemolytic test: Add a small amount of the test solution to 2 to 3 drops of blood on a glass slide; the presence of glycosides is indicated by the appearance of a haemolytic zone.

4.4.7. Carbohydrates testing

Molisch's test: Mix Molisch's reagent with 2 to 3 ml of the test solution; the formation of a violet ring at the junction signals the presence of carbohydrates.

Benedict's test: Combine the test solution with Benedict's reagent; after heating and cooling, the formation of a red, yellow, or orange precipitate signifies the existence of reducing sugars.

Barfoed's test: Add Barfoed's reagent to 2 ml of the test solution, boil for 1 minute, and observe the formation of a red precipitate as an indication of carbohydrates.

4.4.8. Proteins testing

General test: Mix 2 ml of the test solution with 1% copper sulfate and 10% NaOH; the appearance of a pink, purple, or violet color confirms the presence of proteins.

4.4.9. Amino acids testing

Ninhydrin test: Heat the test solution and add 5% ninhydrin solution; the presence of amino acids is indicated by the appearance of a purple or bluish color.

Millon's test: Heat the test solution with Millon's reagent; the confirmation of a red color signifies the existence of. amino acids.[29]

4.5. Acute toxicity studies

In accordance to OECD Test Guidelines 425 (Up and Down Procedure), nulliparous and non- pregnant female albino mice, weighing 28 ± 4 g having age 8–10 weeks were randomly selected. Animals were kept under standard conditions for five days. Limit test was performed at 2000 mg/kg p.o. as single dose and mice were kept without food for 3–4 h prior to dosing but had access to water ad libitum. The dose was administered to a single female mice according tobody weight. The animals were closely observed for first 30 min, thenfor 4 h. Food was provided after 1–2 h of dosing. After survival of treated mouse, 4 additional mice were administered with the same dose under same conditions. The same procedure was followed for vehicle treated control group of 5 mice to whom 1% Carboxymethyl cellulose (CMC) gel was administered in same volume as that of treated group. Both the groups were observed closely for any toxic effect within first 6 h and then at regular intervals for a total period of 14 days. Surviving mice were observed to determine the toxic reactions onset.[30]

4.6. Evaluation of antidepressant activity of *jacquemontia ovalifolia*

Methods employed for evaluating the anti-depressant activity of *Jacquemontia ovalifolia* in Albino mice

4.6.1. Forced swim test[31]

The animals were randomly assigned to four distinct groups, each comprising 6 animals. Animals in GROUP I were designated as the control group. GROUP II animals served as the standard group and were administered Fluoxetine (20mg/kg P.O). GROUP III and GROUP IV functioned as test groups, receiving the ethanolic extract of *Jacquemontia ovalifolia extract*. Behavioral parameters, including the duration of immobility, will be assessed in each animal.

Table 1: Evaluation of anti-depressant activity by forced swim test.

Groups	Drugs	Dose & Route
Group-1 (Control)	Normal Saline	10ml/kg. P.O
Group-2 (Standard)	Fluoxetine	20mg/kg P.O
Group-3 (Test group-1)	*Jacquemontia ovalifolia extract*	200mg/kg P.O
Group-4 (Test group-2)	*Jacquemontia ovalifolia extract*	400mg/kg P.O

The assessment of immobility will occur following the administration of the vehicle, standard drug, and calculated test doses. This evaluation will involve observing the motor activity of mice placed in a water pool.

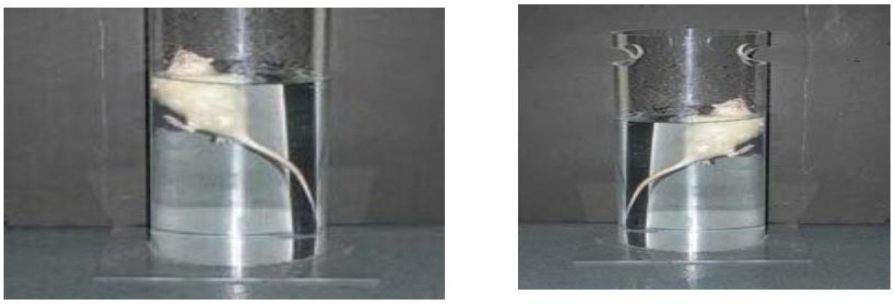


Fig. 5: Forced swim test.

A glass container, cylindrical in shape, with a diameter measuring 18 cm and a height of 40 cm, filled with water up to a height of 15 cm. Measurements were conducted over a span of 6 minutes. Immobility time, defined as the duration during which the animals floated on the water surface with their front paws together, engaging only in the movement's necessary for flotation, was recorded. The recorded immobility times were then compared across control, standard, and test groups. A reduction in immobility duration is indicative of an antidepressant effect, with a shorter immobility time signifying a more potent antidepressant effect.

4.6.2. Tail suspension test[32]

The animals were randomly assigned to four distinct groups, each comprising 6 animals. Animals in GROUP I were designated as the control group. GROUP II animals served as the standard group and were administered Fluoxetine (20mg/kg P.O). GROUP III and GROUP IV functioned as test groups, receiving the ethanolic extract of *Jacquemontia ovalifolia* Behavioral parameters, including the duration of immobility, will be assessed in each animal.

Table No. 2: Evaluation of anti-depressant activity by tail suspension test.

Groups	Drugs	Dose & Route
Group-1 (Control)	Normal Saline	10ml/kg. P.O
Group-2 (Standard)	Fluoxetine	20mg/kg P.O
Group-3 (Test group-1)	*Jacquemontia ovalifolia extract*	200mg/kg P.O
Group-4 (Test group-2)	*Jacquemontia ovalifolia extract*	400mg/kg P.O

Behavioural parameters including the duration of immobility will be assessed in each animal. The evaluation of immobility took place one hour following the administration of the normal saline, standard drug, and test doses.

Fig. 7: Tail suspension test.

The assessment involved observing the motor activity of the mice, which were suspended over the edge of the table, approximately 50 cm above the floor, using an adhesive tape or strip which was placed about 1 cm from the tail tip of the mice. The complete duration of immobility resulting from tail suspension was noted over a 6-minute interval. Animals were classified as immobile when they exhibited complete motionlessness, hanging passively without any bodily movements. The recorded immobility times were subsequently compared across the control, standard, and test groups. A reduction in the duration of immobility indicates an antidepressant-like effect, with a shorter immobility time reflecting a more potent antidepressant effect.

4.6.3. Locomotor activity test

The animals were randomly assigned to four distinct groups, each comprising 6 animals. Animals in GROUP I were designated as the control group. GROUP II animals served as the standard group and were administered Fluoxetine (20mg/kg P.O). GROUP III and GROUP IV functioned as test groups, receiving the ethanolic extract of *Jacquemontia ovalifolia*. Behavioral parameters, including the duration of immobility, will be assessed in each animal.

The locomotor activity of animals was assessed to distinguish between the sedative and central nervous system stimulant effects of drugs. A digital photo actometer was utilized for measurement. Mice were administered two doses of drugs at intervals of 1 hour before the test. Subsequently, the mice were placed in the photo actometer equipped with a fiber lid. As the mice moved around, they intersected the photobeams and the photoactive cells counted the number of interceptions. The locomotion of the animals was quantified by the total number of ambulations (total photobeam counts) observed during a five-minute test for each mouse. Higher the number of counts recorded, stronger is the anti-depressant effect.[32]

5. RESULTS

On preliminary phytochemical analysis of *Jacquemontia Ovalifolia e*xtract showed the presence of flavonoids, saponins, glycosides, terpenoids phenolic compounds amino acids, alkaloids, carbohydrates, and proteins.

Table No. 3: Phytoconstituents.

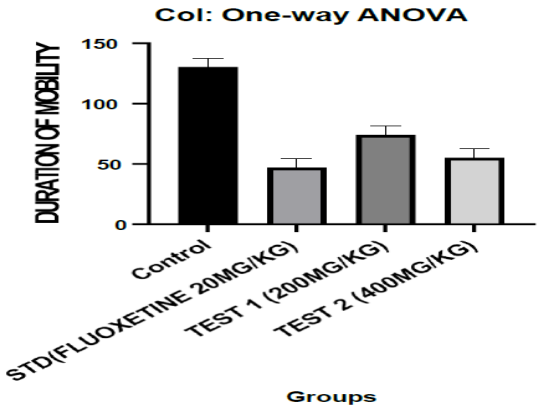
Phytoconstituents	Test performed	Inference
Carbohydrates	i. Molisch's test ii. Benedict's reagent ii. Brontrager's test	Present Present Absent
Glycosides	i. Fehling's test ii. Legal's test	Present Present
Proteins & free amino acids	i. Millon's test ii. Biuret test ii. Ninhydrin test	Present Absent Present
Steroids	i. Salkowski reaction ii. Leberman Burchard reaction	Present Present
Flavonoids	i. Shinoda test ii. Lead acetate test	Present present
Tannins	i. Lead acetate solution ii. Potassium dichromate	Absent Present
Phenolic compounds	i. Lead acetate solution ii. Potassium dichromate	Present Present
Alkaloids	i. Mayer's test ii. Hager's test	Present Present
Fixed oils & fats	i. Filter paper test	Present

5.1. Acute Oral Toxicity test OECD 425 Guidelines

When limit test was conducted with dose of 2000 mg/kg b.w. of *Jacquemontia Ovalifolia* extract by using 1% CMC gel as a vehicle, no mortality was observed. Test animal was observed with special attention for first 30 min and then for 4 h. Observations were recorded at regular time intervals throughout the study period i.e. 14 days.

Table 4: Effects of Ethanolic Extract of Jacquemontia Ovalifolia & Fluoxetine on Forced Swim Test.

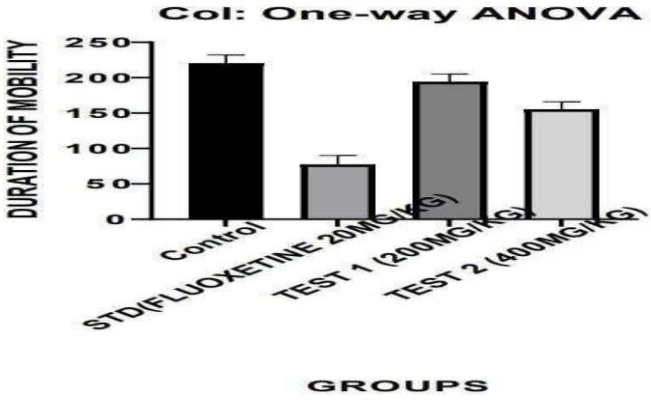
Groups	Treatment	Duration of immobility (SEC)
Normal	10 ML/kg	135.7 ± 5.22****
Fluoxetine	20 mg/kg	46.60 ± 3.28****
Test 1	Ethanolic extract of *Jacquemontia ovalifolia* 200	78.86 ± 5.11****
Test 2	Ethanolic extract of *Jacquemontia ovalifolia* 400	56.69 ± 3.94****



Duration of immobility

Table 5: Effects of ethanolic extract of Jacquemontia ovalifolia & fluoxetine on tail suspension test.

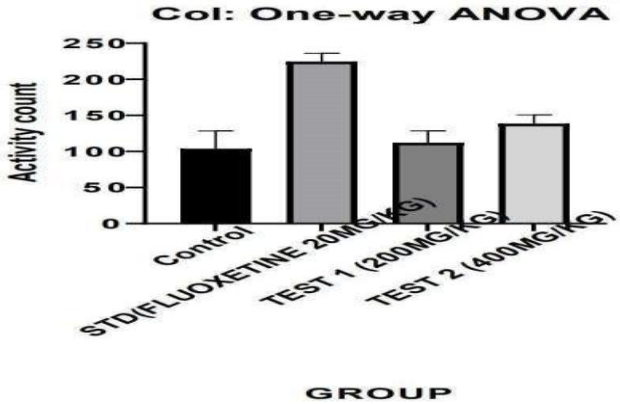
Groups	Treatment	Duration of mobility (sec)	Duration of immobility
Normal	10ml/kg	103 ± 10.02**	220.4 ± 4.76****
Fluoxetine	20mg/kg	224.7 ± 4.62****	77.69 ± 5.09****
Test 1	Ethanolic extract of *Jacquemontia*	112.1 ± 6.78***	194.6 ± 4.36****
Test 2	Ethanolic extract of *Jacquemontia*	138.6 ± 4.96****	155.4 ± 4.30****



Duration of mobility

Table 6: Effects of ethanolic extract of jacquemontia ovalifolia & fluoxetine on locomotor activity test.

Groups	Treatment	Acitivity counts (NO)
Normal	10mg/kg	216 ± 4.23****
Fluoxetine	20mg/kg	91.83 ± 2.02****
Test 1	Ethanolic extract of jacquemontia ovalifolia 200mg/kg	205.7 ± 3.72****
Test 2	Ethanolic extract of jacquemontia ovalifolia 400mg/kg	127.0 ± 5.32****



Activity count

6. DISCUSSION

The current study aimed to assess the antidepressant effects. Of ethanolic extract of *Jacquemontia ovalifolia* in albino mice. As per W.H.O, depression stands as the second most common mental disorder. Globally, affecting an estimated 21% of the world's population. Its highest prevalence occurs among individuals aged 16-35 years. Women are more prone to experience depression than men, with studies indicating that about one third of women will undergo a major depressive episode in their lifetime.

The evaluation of the antidepressant activity of the ethanolic extract of *Jacquemontia ovalifolia* presents a significant avenue for understanding the potential therapeutic effects of this plant in the context of mental health. The ethanolic extract known for its rich phytochemical composition containing alkaloids, flavonoids, antioxidants, saponins, carbohydrates etc is believed to possess potential antidepressant properties.

The following methods were employed in this study for evaluating the anti- depressant activity:

1. Forced Swim test
2. Tail suspension test
3. Locomotor activity

The animals were randomly assigned to four distinct groups, each comprising 6 animals. Animals in GROUP I were designated as the control group. GROUP II animals served as the standard group and were administered Fluoxetine (20mg/kg P.O). GROUP III and GROUP IV functioned as test groups, receiving the ethanolic extract of *Jacquemontia ovalifolia*.

The findings derived from the study indicated a noteworthy anti-depressant effect *Jacquemontia ovalifolia*. Key behavioral parameters, such as immobility time in the forced swim test and tail suspension test, demonstrated a significant reduction, suggesting a potential decreasing of depressive symptoms. Additionally, biochemical analyses, such as the assessment of neurotransmitter levels, provided insights into the possible mechanisms underlying the observed antidepressant activity.

The implications of these findings extend beyond the mere demonstration of antidepressant properties. *Jacquemontia ovalifolia*, as a natural source, holds promise for the development of novel anti-depressant agents with potentially lesser side effects compared to conventional medications.[33]

In this context, it can be stated that. the ethanolic extract of *Jacquemontia ovalifolia* is effective and it is a natural alternative of allopathic medications to manage moderate depression.

However, it is essential to acknowledge certain limitations within the scope of this study. The translation of results from animal models to human clinical trials requires careful consideration of species differences and potential side effects. Moreover, the study might benefit from further investigations into the long-term effects, optimal dosage, and potential interactions with other medications.[33]

7. CONCLUSION

The evaluation of the antidepressant activity of the ethanolic extract of *Jacquemontia ovalifolia* has provided valuable insights into its potential therapeutic effects. The experimental findings suggest that the extract possess antidepressant properties as evidenced by the results and observations from the study. These results warrant further investigation and exploration of *Jacquemontia ovalifolia* as a potential natural remedy for managing depressive disorders.

Additional research is required to identify and separate the active component, enabling the examination of its mechanism of action and the identification of the primary chemical constituents responsible for exhibiting anti-depressant properties.

8. ACKNOWLEDGEMENT

This project work has been carried out under the supervision of guide, **DR. DV KISHORE Professor & HOD**, Department of Pharmacology, Shadan College of Pharmacy, Hyderabad.

We respectfully express our indebtedness for his valuable guidance and encouragement throughout the project work. With his support, guidance, and ideas we could complete our project work successfully. We wish to express our deep sense of gratitude to him for suggesting this topic and whole heartedly thank him for the insight he gave us about our topic.

We, with great gratitude, thank our honorable Director, **Dr. SHAIK MOHAMMED KHASIM**, for being a constant source of encouragement and nourishing us with invaluable advices that has laid a firm foundation of knowledge and prudence in us. We also take this opportunity to extend regards and thanks to our Principal**, Dr. R. SRIDHAR BABU** who had been a source of inspiration, guidance, motivation and their support to make the study a success We also thank to our Vice Principal **Dr. D. V. KISHORE**, who had been a source of inspiration to make this project a success.

With all our regards, we thank our **entire faculty**, who polished our talents and skills in the journey of field of pharmacy. Also, we express our gratitude to those who directly or indirectly helped us in completing our project. Above all words fail to express our feelings to our **PARENTS** for their constant support, motivation and encouragement. In the end, above all, we extend our sincere gratitude to God Almighty for his blessings.

REFERENCES

1. Ferrari AJ, Charlson FJ, Norman RN, Patten SB, Freedman G, CGL M, Vos T, Whiteford HA. Burden of depressive disorders by country, sex, age, and year: findings from the global burden of disease study 2010. PLoS Med, 2013; 10(11): 1–12.
2. Smith AJ, Sketris I, Cooke C, Gardner D, Kisely S, Tett SE. A comparison of antidepressant use in Nova Scotia, Canada and Australia. Pharmacoepidemiol Drug Saf, 2008; 17(7): 697–706.
3. Schildkraut JJ, Gordon EK, Durell J. Catecholamine metabolism in affective disorders. I. Normetanephrine and VMA excretion in depressed patientstreated with imipramine. J Psychiatr Res, 1965; 3(4): 213–28.
4. Michel TM, Frangou S, Thiemeyer D, Camara S, Jecel J, Nara K, Brunklaus A,Zoechling R, Riederer P. Evidence for oxidative stress in the frontal cortex inpatients with recurrent depressive disorder—a postmortem study. Psychiatry Res, 2007; 151(1–2): 145–50.
5. Cryan JF, Lucki I. Antidepressant like behavioral effects mediated by hydroxyl tryptamine receptors. The Journal of Pharmacology experimental Therapeutics, 2000; 295: 1120–6.
6. Dhingra D, Sharma A. Review on antidepressant plants. Natural Products Radiance, 2005; 144– 52.
7. Zhang J, Wu J, Fujita Y, Yao W, Ren Q, Yang C, Li S, Shirayama Y, Hashimoto K. Antidepressant effects of TrkB ligands on depression-like behaviour and dendritic changes in mice after inflammation. Int J Neuropsychopharmacol, 2015; 1–12.
8. Ghani A. Medicinal plants of Bangladesh. The Asiatic Society of Bangladesh: Dhaka, 1998.
9. Akobundu IO, Agyakwa C. A handbook of west African weeds. Ibadan (Nigeria): International institute of tropical agriculture, 1987.
10. Burkill HM. The useful plants of west tropical Africa. Edition Royal Botonaic Gardens Kew: London, 1985; 431–2.
11. David BLAc. Medicine at your feet: Healing plants of the Hawaiian Kingdom Commelina diffusa (Honohono), 1998. http://www.medicineatyourfeet.com/
12. Leonard DB. Medicine at your feet: Healing plants of the Hawaiian Kingdom, 2012; 1. http://www.medicineatyourfeet.com/
13. Seaforth CE, Adams CD, Sylvester Y. A guide to the medicinal plants of Trinidad and Tobago. Commonwealth Science Council, Commonwealth Secretariat, London, UK, 1983; 222.
14. Beira A, Leon MC, Iglesias E, Ferrandiz D, Herrera R, Volpato G, Godinez D, Guimarais M. Alvarez R. Estudios etnobotanicos sobre plantas medicinales en la provincia de Camaguey (Cuba) Anales del Jardín Botánico de Madrid, 2004; 61(2): 185–203.
15. Khan MAA, Islam MT, Sadhu SK. Evaluation of phytochemical and antimicrobial properties of Commelina diffusa Burm. f. Orient Pharm Exp Med, 2011; 11(4): 235–241.
16. Mensah AY, Houghton PJ, Dickson RA, Fleischer TC, Heinrich M, Bremner P. In vitro evaluation of effects of two Ghanaian plants relevant to wound healing. Phytother Res, 20(11): 941–4.
17. Houghton PJ, Hylands PJ, Mensah AY, Hensel A, Deters AM. In vitro tests and ethnopharmacological investigations: wound healing as an example. J Ethnopharmacol, 2005; 100(1): 100–7.
18. Plants HJL. Used against cancer. A survey. Lloydia, 1969; 32: 247–96.
19. Youn JY, Park HY, Cho HK. Anti-hyperglycemic activity of Commelina communis L.: inhibition of α-glucosidase. Diabetes Res Clin Pract, 2004; 66: 149–55.
20. Oudhia, P. Kaua-kaini (Commelina benghalensis Linn.) Society for Parthenium Management (SOPAM) 28-A, Greeta Nagar, Raipur – 492001 India, 2004.
21. Walker CIB, Trevisan G, Rossato MF, Franciscato C, Pereira ME, Ferreira J, Manfron MP. ntinociceptive activity of Mirabilis jalapa in mice. J Ethnopharmacol, 2008; 120: 169–75.
22. Ghani A. Medicinal plants of Bangladesh with chemical constituents and uses. 2nd ed. Dhaka, Bangladesh: The Asiatic Society of Bangladesh, 2003; 331–2.
23. Gupta BD, Dandiya PC, Gupta ML. A psychopharmacological analysis of behavior in rat. Japan J Pharm, 1971; 21: 293–8.
24. Takagi K, Watanabe M, Saito H. Studies on the spontaneous movement of animalsby the hole cross test: effect of 2-dimethylaminoethane. Its acylates on the central nervoussystem. Jpn J Pharmacol, 1971; 21: 797–810.
25. Porsolt RD, Bertin A, Behavioural JM. Despair in mice: a primary screening test for antidepressants. Archives Internationales de Pharmacodynamie et de Therapie, 1977; 229: 327– 36.
26. Steru L, Chermat R, Thierry B, Simon P. The tail suspension test: a new method for screening antidepressants in mice. Psychopharmacology, 1985; 85: 367–70.
27. Hossain MM, Hasan SMR, Akter R, Islam MN, Saha MR, Rashid MJ, Saha MR, Mazumder MEH, Rana S. Evaluation of analgesic and neuropharmacological properties of the aerial part of Tinospora cordifolia miers.In mice. Stam J Pharma Scis, 2009; 2: 31–7.
28. Protapaditya D, Sangita C, Priyanka C, Sanjib B. Neuropharmacological properties of Mikania candens (L.) Willd. (Asteraceae). Journal of Advanced Pharmaceutical Technology and Research, 2011; 2(4): 255–9.
29. Mansur R, Martz W, Effects CE. Of acute and chronic administration of Cannabis Satis and (−) 9-transtetrahydrocannabinaol on the behaviour of rats in open field arena. Psychopharmacol, 1980; 2: 5–7.
30. U. Saleem, S. Amin, B. Ahmad, H. Azeem, F. Anwar, S. Mary Acute oral toxicity evaluation of

aqueous ethanolic extract of Saccharum munja Roxb. roots in albino mice as per OECD 425 TG Toxicol. Rep, 2017; 1(4): 580-585.
31. Kavita G, Vijay KL, Shivesh J. Anticonvulsant potential of ethanol extractsand their solvent partitioned fractions from Flemingia strobilifera root. Pharm Res, 2013; 5(4): 265–70.
32. Kumar K, Sharma S, Kumar P, Deshmukh R. Therapeutic potential of GABA(B) receptor ligands in drug addiction, anxiety, depression and other CNS disorders. Pharmacol Biochem Behaviour, 2013; 110: 174–84.
33. Uma AB, Radha Y, Prachi DP, Mandar RZ, Rahul SS. Study of central nervous system depressant and behavioral activity of an ethanol extract of Achyranthes aspera(Agadha) in different animal models. International Journal of Applied and Basic Medical Research, 2011; 1(2): 104–8.