Journal of Chemical and Pharmaceutical Sciences

Journal of Chemical and Pharmaceutical Sciences-JCHPS (2026) 19 (3): 57-64
Online ISSN: Online 2349-8552, Print ISSN: 0974-2115
Research Article | Pharmaceutical Sciences | MCI Approved | Peer-Reviewed | Referred | OA Journal |

Anti-Depressant Activity of *Acronus Calamus* Plant Extract by Using Suitable Animal Model

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Received: 16 April 2026 / Accepted: 22 May 2026/ Published online: 01 July 2026
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ABSTRACT

Depression is a multifactorial neuropsychiatric disorder often associated with neurotransmitter imbalances and oxidative stress. The present study evaluated the potential antidepressant and antioxidant effects of *Acronus Calamus* extract in a reserpine-induced depression model in mices. Animals were divided into six groups: control, reserpine-only, fluoxetine-treated, and three groups treated with varying doses (10, 150, and 200 mg/kg) of *Acronus Calamus* extract along with reserpine. Behavioral assessments were conducted using the Forced Swim Test (FST), Tail Suspension Test (TST), and Open Field Test (OFT) to evaluate depressive-like and exploratory behaviors. Biochemical analysis included measurement of serum and brain malondialdehyde (MDA) levels, as well as brain antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and reduced glutathione (GSH). Reserpine treatment significantly increased immobility time and MDA levels, while reducing antioxidant enzyme activity, indicating both behavioral despair and oxidative stress. Fluoxetine and *Acronus Calamus* at 200 mg/kg significantly reversed these effects, showing reduced immobility, improved exploratory behavior, and restoration of antioxidant status. The results demonstrated that *Acronus Calamus* extract exhibits dose-dependent antidepressant-like effects, with the 200 mg/kg dose showing efficacy comparable to fluoxetine. The extract also significantly mitigated oxidative stress markers, suggesting its neuroprotective potential. In conclusion, *Acronus Calamus* may serve as a promising natural therapeutic agent for depression, potentially acting through modulation of oxidative stress and central monoaminergic pathways. Further investigations are warranted to isolate its active constituents and explore its mechanisms in chronic depression models.

KEY WORDS: *Acronus Calamus*, Antidepressant Activity

INTRODUCTION

Depression, also known as Major Depressive Disorder (MDD), is a common mental health disorder characterized by persistent sadness, loss of interest or pleasure in daily activities, low energy, and impaired emotional and physical functioning. These symptoms usually persist for at least two weeks and significantly affect an individual's personal, social, and occupational life. Depression is caused by a combination of biological, psychological, genetic, and environmental factors, including neurotransmitter imbalance, stress, trauma, and family history.

Types of Depression

The major types of depression include:

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Major Depressive Disorder (MDD): Severe depression with persistent low mood and loss of interest lasting at least two weeks.

Persistent Depressive Disorder (Dysthymia): A chronic, milder form of depression lasting for two years or more.

Bipolar Disorder: Characterized by alternating episodes of depression and mania (elevated mood and energy).

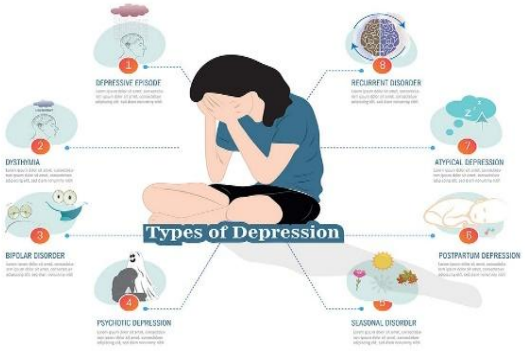
Postpartum Depression: Develops after childbirth and is associated with sadness, anxiety, and emotional exhaustion.

Seasonal Affective Disorder (SAD): Depression occurring during specific seasons, usually due to reduced sunlight exposure.

Psychotic Depression: Severe depression accompanied by psychotic symptoms such as delusions or hallucinations.

Premenstrual Dysphoric Disorder (PMDD): Severe mood disturbances occurring before menstruation.

Situational Depression (adjustment disorder): Depression triggered by stressful life events such as loss, failure, or major life changes.



Symptoms, Diagnosis and Causes

Common symptoms of depression include persistent sadness, loss of interest in activities, fatigue, sleep disturbances, appetite changes, difficulty concentrating, feelings of guilt or worthlessness, and in severe cases, suicidal thoughts. Diagnosis is based on clinical evaluation, mental health assessment, symptom duration of at least two weeks, and the impact on daily functioning.

Depression results from the interaction of several factors:

Biological factors: Imbalance of neurotransmitters such as serotonin, norepinephrine, and dopamine.

Genetic factors: Family history increases susceptibility.

Psychological factors: Chronic stress, trauma, and negative thinking.

Environmental factors: Social isolation, financial problems, bereavement, and other stressful life events.

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Recent studies also suggest that depression is associated with HPA-axis dysfunction, increased cortisol levels, neuroinflammation, reduced brain-derived neurotrophic factor (BDNF), and structural changes in the brain such as reduced hippocampal volume.

Treatment of Depression

Depression is a treatable condition. Management includes pharmacotherapy, psychotherapy, lifestyle modification, and social support.

Classification of Drug

1.Reversible inhibitor of MAOA[RIMAS]	Moclobemide Clorgyline
2.Tricyclic antidepressants [TCAs]	Impramine Amitriptyline Clomipramine Desipramine Nortriptyline
3.Selective serotonin reuptake inhibitor [SSRIS]	Fluoxetine Sertaline Citalopram Escitalopram
4. Atypical antidepressants	Trazodone Minaserin Duloxetine Bupropion

Mechanism of Action

Most antidepressants act by increasing the availability of monoamine neurotransmitters, particularly serotonin, norepinephrine, and dopamine, in the central nervous system.

TCAs inhibit the reuptake of serotonin and norepinephrine but may produce anticholinergic and cardiovascular side effects.

SSRIs selectively inhibit serotonin reuptake and are considered first-line drugs because of their better safety profile.

SNRIs increase both serotonin and norepinephrine levels.

MAO inhibitors prevent enzymatic breakdown of monoamines, thereby increasing neurotransmitter concentrations.

Adverse Effects and Toxicity

Common adverse effects of antidepressants include nausea, dry mouth, constipation, dizziness, sedation, insomnia, weight gain, sexual dysfunction, and headache. TCAs are associated with a higher risk of cardiac toxicity and are dangerous in overdose. SSRIs generally have a wider safety margin but may cause gastrointestinal disturbances and, in excessive doses or when combined with other serotonergic drugs, can lead to serotonin syndrome. Drug interactions with alcohol and central nervous system depressants increase the risk of toxicity.

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Acronus Calamus

MATERIALS AND METHODS

Collection and Identification of Plant Material

The *Acronus Calamus* leaves are collected and identified. Collection of Plant Dried was purchased from surroundings of Nalgonda District 4th April 2026. and authenticated by

Preparation of the maceration

The collected *Acronus Calamus* washed, air dried, homogenized to fine powder and stored in airtight bottles. and then extracted with Ethanol by using the maceration process.

Maceration procedure:

1. **Preparation**: wash fresh leaves thoroughly to remove soil, cut in to small pieces, and air day in shade or at 40°C-50°C until constant weight, then grind in to a coarse powder.

2. Maceration Ratio; - Mix the powder with the solvent. A Common ratio is 100g of powder in 800ml to 1000ml (or higher 1:15 ratio) of solvent.

3. Solvent selection:

1. Ethanol / water [70-80%]: suitable for general phytochemistry and flavonoid extraction
2. **Methanol Dichloromethane:** [1:1] used for extracting organic compounds volatile**.**

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4. Duration and Agitation*:* Allow the mixture to macerate (soak) for 24 hints to 7 days at room temperature Ideally with occasional shaking or stirring for maximum extraction

5. Filtration*:* Filter the mixture: Through, for example, filter paper or cloth to remove the raw plant material

6. Concentration: Evaporate the solvent under reduced pressure using a rotary evaporator at low temperature [e.g..45°C-50°C] to obtain the concentrated crude extract

EXPERIMENTAL DESIGN

I Group: Control (Normal saline) 1 mL/kg

II Group: Reserpine only (Depressed control) 5 mg/kg

III Group: Fluoxetine + Reserpine Fluoxetine: 150 mg/kg reserpine: 5 mg/kg

Behavioural test

Forced Swim Test (FST) Procedure for Mice

The Forced Swim Test (FST) is a validated behavioural model used to assess antidepressant-like activity in mice. In this procedure, each rat is placed individually in a vertical glass cylinder (typically 40 cm in height and 20 cm in diameter) filled with water to a depth of 30 cm, maintained at a temperature of 25±1 °C, ensuring the animal cannot touch the bottom or escape. The test consists of two sessions. In the pre-test session (habituation), each mice is placed in the water for 15 minutes and then removed, dried, and returned to its home cage. Twenty-four hours later, the test session is conducted, where each mice is placed in the same cylinder for 5 minutes. The behavior is observed and recorded, focusing on three main parameters: immobility (floating with animal movements to keep the head above water), swimming, and climbing. Antidepressant treatment typically reduces immobility time and increases active behaviors like swimming or climbing, depending on the drug's mechanism. After the session, rats are dried with a

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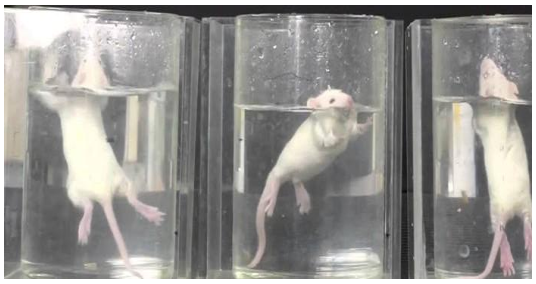
towel and kept warm before returning to their cages, this test is commonly used due to its sensitivity to various classes of antidepressant agents, such as SSRIs and tricyclic antidepressants



RESULT:

Qualitative phtochemical analysis of *Acronus Calamus*

SI. NO	Phytoconstituents	Leaf
1	Carbohydrates	+
2	Proteins	+
3	Fats	+
4	Glycosides	+
5	Alkaloids	+
6	Tannins	+
7	Phobatannins	-
8	Flavonoids	+
9	Steroids	+
10	Saponins	+
11	Phenolic Compounds	+
12	Phytosterols	+

Immobility Time: Lower immobility time = higher anti-depressant effect

% Decrease: [(Control - Test) / Control] × 100

Imipramine: Standard anti-depressant, usually 10mg/kg i.p.

n value: Mention number of mice/group below table. Example: Values are Mean ± SEM, n=6.

Analysed by one-way ANOVA followed by Dunnett's test.

GROUP	Treatment	Dose	FST-Immobility Time(sec)	% Decrease Vs Control
GROUP-1	Normal Saline	10ml	165.2±4.8	2%
GROUP-2	Calamus Extract	100mg/kg	138.6±5.1	16.1%
GROUP-3	Calamus Extract	200mg/kg	115.4±4.3	30.1%
GROUP-4	Standard Imipramine	10mg/kg	98.2±3.9	40.6%

Effect of *Acronus Calamus* extract on Anti-Depressant Activity in Mice

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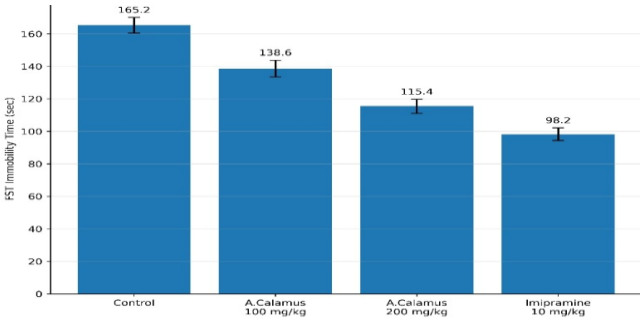

Forced swim test (mean ± SEM)

DISCUSSION

Evaluated the antidepressant-like and antioxidant effects of *Acorus calamus* extract in a reserpine-induced depression model in rats. The Forced Swim Test (FST) and biochemical analyses, including malondialdehyde (MDA) levels and brain antioxidant enzyme activities, were performed. Reserpine-treated rats showed increased immobility time, confirming depression-like behavior. Reserpine depletes serotonin, dopamine, and norepinephrine, thereby causing behavioral despair. Imipramine significantly reduced immobility time, validating the depression model. *Acorus calamus* at a dose of 200 mg/kg significantly reduced immobility time, with an effect comparable to that of imipramine, whereas the 100 mg/kg dose showed no significant behavioral improvement. These results indicate a dose-dependent antidepressant effect.

The FST is a reliable and widely accepted model for assessing antidepressant activity. *Acorus calamus* reduced serum and brain MDA levels, indicating antioxidant activity. Imipramine also reduced MDA levels, supporting its antioxidant effect. Overall, *Acorus calamus* exhibited significant antidepressant-like and antioxidant effects in the reserpine-induced depression model. These findings suggest that *Acorus calamus* may be a promising natural therapeutic agent for depression associated with oxidative stress.

CONCLUSION

The study demonstrated that *Acorus calamus* plant extract possesses significant antidepressant-like activity in a reserpine-induced depression model. The extract, particularly at a dose of 200 mg/kg, reduced depressive-like behavior, improved antioxidant enzyme levels, and decreased oxidative stress, showing effects comparable to those of standard antidepressant drugs. These findings suggest that *Acorus calamus* has promising therapeutic potential for the management of depression. However, further studies are required to confirm its safety, elucidate its precise mechanism of action, establish optimal dosing, and determine its clinical applicability.

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