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Original Research Article

Therapeutic Evaluation of Saraca indica Bark Extract for Antidepressant and Anxiolytic Activities.

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Abstract: The present study investigates the antidepressant and anxiolytic potential of methanolic bark extract of Saraca indica (SI). Behavioural models such as Forced Swim Test (FST), and Tail Suspension Test (TST) Elevated Plus Maze (EPM), Open Field Test (OFT) and Light-Dark Box (LDB), were employed to evaluate its effects. Phytochemical screening revealed the presence of flavonoids, alkaloids, saponins, and tannins, which are known for their neuropharmacological properties (1,2) . Administration of SI extract (100 mg/kg) immobility time in FST and TST was markedly reduced, significantly increased open arm time (EPM), centre time (OFT), and light chamber time (LDB), was indicating both anxiolytic and antidepressant activity. The observed effects were comparable to fluoxetine used as standard antidepressant and anxiolytic drugs respectively (3, 4). These findings suggest that Saraca indica bark extract may be a promising natural alternative for the management of depression and anxiety (5,6).

Keywords: Saraca indica, bark extract, antidepressant activity, anxiolytic activity, behavioural models, Forced Swim Test (FST), Tail Suspension Test (TST), Elevated Plus Maze (EPM), Open Field Test (OFT), Light-Dark Box (LDB), phytochemicals.

INTRODUCTION

Depression and anxiety are among the most prevalent mental health disorders globally, often occurring concurrently and significantly impairing quality of life.

The adverse effects and limitations of conventional drugs such as benzodiazepines and selective serotonin reuptake inhibitors (SSRIs) have led to increased interest in plant-based therapies [6,7,11]. *Saraca indica*, a traditional Ayurvedic plant, is rich in bioactive phytochemicals that may modulate neurotransmitter activity [1, 8]. While *Saraca indica* has been extensively studied for its antioxidant and anti-inflammatory properties, limited research exists on its neurobehavioral effects [2, 5]. The present study aims to evaluate the antidepressant and anxiolytic activities of *Saraca indica* bark extract in animal models.

MATERIALS AND METHODS

PLANT MATERIAL AND EXTRACTION: Bark of *Saraca indica* was collected, authenticated, the bark of *Saraca indica* was collected, authenticated, by Head of the Botany Department. ICFRE, Himalayan forest research institute of Government College, Himalayan, India for **Authentication Certificate Number** is "Ref. No. SHIMA.A-171013(HP)". The bark of *Saraca indica* (Ashoka tree) was collected from Durgapur (W.B) India in November 2023. The plant materials were identified and verified by ICFRE-Himalayan Forest research institute.

The bark was dried, and powdered. Methanolic extraction was performed using a Soxhlet apparatus for 6-8 hours until the siphoning solvent became colourless. The extract was concentrated using a rotary evaporator and stored at 4°C.

ANIMALS: Swiss albino mice (20–25 g) of either sex were used, housed under standard conditions with free access to food and water. All experiments procedures were followed guidelines for the care and

use of laboratory animals and were approved by the Institutional Animal Ethics Committee (IAEC) of DMIHER, as per CPCSEA regulations (Approval No.: DMIHER/IAEC/24-25/28).

EXPERIMENTAL DESIGN:

Animals were divided into five groups (n=6):

1. **Group I (Control)**:
   Normal saline, 10 ml/kg, orally (p.o.).
2. **Group II (Positive Control)**:
   Fluoxetine 10 mg/kg,p.o
   After 1 hour → Reserpine 5 mg/kg, intraperitoneal (i.p.).
3. **Group III (*Saraca indica* + Reserpine)**:
   Saraca indica extract 100 mg/kg, p.o.
   After 1 hour → Reserpine 5 mg/kg, i.p.

BEHAVIORAL TESTS:

- **Forced Swim Test (FST):** Duration of immobility was noted to assess depression like activity[12].
- **Tail Suspension Test (TST):** Immobility time was recorded as an indicator of depression-like behaviour[13].
- **Elevated Plus Maze (EPM):** Time spent in open arms measured anxiolytic activity[14].
- **Open Field Test (OFT):** Center time and locomotion were recorded because they indicate anxiolytic activity[15].
- **Light Dark Box Test (LDB):** Time spent in the light chamber was observed as a measure of anxiolytic activity[16].

STATISTICAL ANALYSIS AND DATA REPRESENTATION

STATISTICAL ANALYSIS

Data were analysed using one-way analysis of variance (ANOVA) to determine group differences, followed by Tukey's post hoc test for pairwise comparisons. Statistical significance was set at $p < 0.05$, and all values are presented as mean ± standard error of the mean (SEM)

DATA REPRESENTATION

Table 1: Effects of *Saraca indica* on Behavioural Parameters Groups
FST (Immobility Time) TST (Immobility Time) EPM (Open Arm Time) OFT (Centre Time) LDB (Light Chamber Time).

Table: 1 Comparative Analysis of Treatment Groups on Behavioural Test

Groups	FST (Immobility Time)	TST (Immobility Time)	EPM(Open Arm Time)	OFT (Centre Time)	LDB (Light Chamber Time)
Control	180 ± 10 sec	190 ± 8 sec	45.3 ± 2.5 sec	15.4 ± 1.2 sec	80.3 ± 3.4 sec
Standard	110 ± 5 sec	90 ± 6 sec	85.7 ± 3.1 sec	35.8 ± 2.5 sec	140.6 ± 5.2 sec
S. indica	160 ± 8 sec	140 ± 6 sec	65.8 ± 2.9 sec	26.7 ± 2.3 sec	105.4 ± 4.2 sec

Standard Treatment Shows Maximum Efficacy:

- The standard drug group significantly reduced immobility time in **FST (110 ± 5 sec)** and **TST (90 ± 6 sec)** compared to control (**FST: 180 ± 10 sec**, **TST: 190 ± 8 sec**), indicating strong **antidepressant** activity.
- It also showed the highest increase in **open arm time in EPM (85.7 ± 3.1 sec)**, **centre time in OFT (35.8 ± 2.5 sec)**, and **light chamber time in LDB (140.6 ± 5.2 sec)**, indicating potent **anxiolytic** effects.

***Saraca indica* Exhibits Moderate Antidepressant Effects:**

- Reduced immobility time in **FST (160 ± 8 sec)** and **TST (140 ± 6 sec)** compared to control, but less effective than the standard.

***Saraca indica* Demonstrates Noticeable Anxiolytic Activity:**

- Improved behavioural scores in **EPM (65.8 ± 2.9 sec)**, **OFT (26.7 ± 2.3 sec)**, and **LDB (105.4 ± 4.2 sec)** compared to control, suggesting moderate anxiolytic properties.

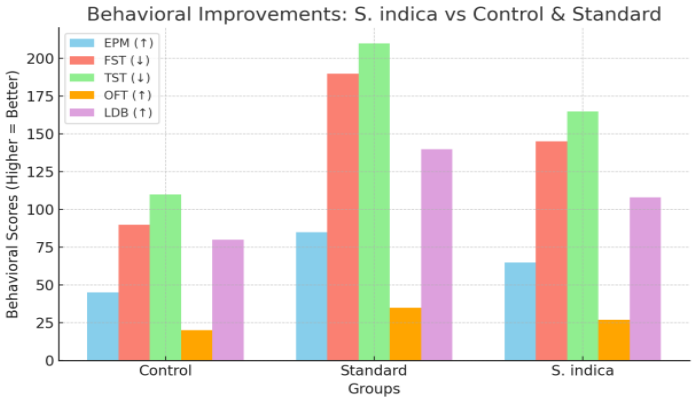
Control Group Shows Signs of High Depression and Anxiety-like Behaviour:

- Highest immobility times in FST and TST, and lowest scores in EPM, OFT, and LDB, confirming the baseline for depression and anxiety behaviour.

Overall Conclusion:

- While the **standard treatment** is the most effective, ***S. indica*** **shows promising antidepressant and anxiolytic potential**, warranting further investigation as a therapeutic agent.

Graphical representation



The graph compares behavioural improvements between S. indica (treatment), Control, and Standard groups across various parameters (BPM, EPM, FST, TST, OFT, LDB).
- Control Group: Shows baseline behavioural scores
- Standard Group: Generally exhibits higher behavioural scores compared to Control and S. indica.
- S. indica Group: Shows distinct patterns compared to Control and Standard, with some parameters having lower scores (like OFT) and others comparable or higher.

The graph suggests S. indica has varying effects on behavioural improvements compared to Control and Standard groups. The Standard group tends to show higher improvements in most parameters. Specific conclusions would depend on the context of the study (e.g., effects of S. indica in a particular application or model).

RESULTS

Phytochemical Analysis: The methanolic extract confirmed the presence of alkaloids, flavonoids, tannins, saponins, and phenolic compounds [1, 2].

EPM: SI extract (100 mg/kg) significantly increased open arm time compared to control ($p < 0.01$), indicating anxiolytic activity [3].

FST & TST: A significant reduction in immobility time was recorded, suggesting antidepressant activity [1, 2, 4].

OFT & LDB: Increased exploration and time in the centre and light chamber were observed with SI extract [3, 6].

Comparison with Standard Drugs: SI extract at 100 mg/kg showed effects comparable to fluoxetine [3, 4].

DISCUSSION

The present study demonstrates that the methanolic bark extract of Saraca indica exhibits significant antidepressant and anxiolytic activities in Swiss albino mice. The reduction in immobility time observed in the Forced Swim Test (FST) and Tail Suspension Test (TST) indicates a marked antidepressant effect, comparable to standard drugs[12,13]. Similarly, increased time spent in open arms in the Elevated Plus Maze (EPM), increased time in the light compartment in the Light–Dark Test (LDT), and enhanced exploratory behavior in the Open Field Test (OFT) suggest notable anxiolytic activity[14-16].The antidepressant effect may be attributed to the modulation of monoaminergic neurotransmission, particularly involving serotonin (5-HT), norepinephrine (NE), and dopamine (DA) pathways. Flavonoids, tannins, and other polyphenolic compounds present in the bark extract are known to influence central neurotransmitter levels either by inhibiting monoamine oxidase (MAO) activity or enhancing synaptic availability of monoamines. Additionally, oxidative stress plays a crucial role in the pathophysiology of depression and anxiety disorders[17]. The antioxidant properties of the phytoconstituents present in Saraca indica may contribute to neuroprotection by reducing reactive oxygen species (ROS) and lipid peroxidation in brain tissues.The behavioral improvement observed across multiple experimental models strengthens the reliability of the findings, as each model evaluates different aspects of depressive and anxiety-like

behavior. The consistency of results across these models supports the hypothesis that Saraca indica possesses central nervous system (CNS) modulatory activity. Furthermore, the absence of significant toxicity at tested doses indicates a favorable safety profile, which is essential for potential therapeutic application.These findings also validate the traditional use of Saraca indica in managing stress-related and mood disorders in Ayurvedic medicine. However, while the results are promising, the exact molecular mechanisms remain to be elucidated. Further studies involving biochemical estimations, receptor-binding assays, neurotransmitter quantification, and gene expression analysis are necessary to clarify the precise pathways involved.

CONCLUSION

In conclusion, the methanolic bark extract of Saraca indica demonstrates significant antidepressant and anxiolytic effects in validated animal models. The observed pharmacological activity is likely due to its rich phytochemical composition, including flavonoids, tannins, glycosides, and other bioactive constituents that may modulate monoaminergic neurotransmission and exert antioxidant effects.The extract showed consistent behavioral improvements across different experimental paradigms, suggesting a broad spectrum of CNS activity. Importantly, the study indicates that Saraca indica may serve as a potential natural therapeutic agent or adjunct in the management of depression and anxiety disorders. Its favorable safety profile further enhances its potential for future development.However, this study is limited to preclinical evaluation in animal models. Therefore, detailed mechanistic studies, chronic toxicity assessments, pharmacokinetic profiling, and well-designed clinical trials are necessary before translating these findings into clinical practice. Future research should also focus on isolating and characterizing the active phytoconstituents responsible for the observed effects.Overall, the present investigation provides scientific evidence supporting the traditional use of Saraca indica and opens new avenues for the development of plant-based antidepressant and anxiolytic therapies.

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