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Therapeutic Evaluation of *Mangifera indica* Bark Extract for Antidepressant and Anxiolytic Activities

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abstract
The bark of Mangifera indica (mango tree) has been traditionally used in various medicinal systems for its neuroprotective, antioxidant, and anti-inflammatory properties(1,6) . The present study evaluates the antidepressant and anxiolytic activities of M. indica bark extract in animal models. Methanolic extract was prepared using Soxhlet extraction and tested at doses of 100 mg/kg. Behavioral paradigms such as the (Forced Swim Test (FST), Tail Suspension Test (TST) Elevated Plus Maze (EPM and Open Field Test (OFT), Light Dark Apparatus (LDT) were employed. Results showed a significant increase in open arm time (EPM) and center time (OFT), with a marked reduction in immobility time (FST and TST), indicating potent anxiolytic and antidepressant effects comparable to standard drugs (fluoxetine)(8) . These findings suggest M. indica bark extract as a promising natural alternative for managing depression and anxiety disorders.

keywords: *Mangifera indica, bark extract, anxiolytic, antidepressant, behavioral models, fluoxetine*

1. INTRODUCTION

Depression and anxiety are among the most prevalent psychiatric disorders worldwide, often managed with synthetic drugs that may cause side effects. Medicinal plants have gained attention as alternative therapies due to their safety profile and multi-target mechanisms [1]. *Mangifera indica*, commonly known as the mango tree, is rich in phytochemicals like mangiferin, phenolics, and flavonoids with neuropharmacological potential [2, 3]. Although its fruits and leaves have been studied extensively, limited data exist on the bark extract's anxiolytic and antidepressant properties. This study aims to evaluate the therapeutic potential of *M. indica* bark extract using validated animal behavioral models.

Humans frequently experience sadness and unhappiness. Everyone has these feelings from time to time, but they go away in a few days, but in the case of depression, the duration and intensity are different from normal [4]. More than 300 million people worldwide are impacted. According to a WHO research, depression diagnoses are on the rise worldwide and account for a significant portion of treatment costs. Antidepressant medication combined with psychotherapy sessions can help alleviate the symptoms of depression [4]. According to earlier research and the pathophysiology of depression, the mechanism of action of several antidepressant classes, including monoamine oxidase inhibitors (MAOIs), selective serotonin reuptake inhibitors (SSRIs), and tricyclic antidepressants (TCAs), may be attributed to specific receptors, including serotoninergic and noradrenergic ones. The monoamine hypothesis states that depression develops as a result of a decrease in serotonin and noradrenaline levels in the central nervous system. Consequently, the goal of all successful treatment plans is to increase the brain's serotonin or noradrenaline levels. The currently recommended standard antidepressant medications have a number of drawbacks, including a delayed onset of therapeutic efficacy, a high rate of insensitive individuals, weight gain, and sexual dysfunction [5]. Because they have a high concentration of bioactive chemicals that can improve human health, seeds that are thrown as a wasted part of *Mangifera indica* (M. indica) have attracted special scientific attention. Because the seeds are a good source of carbohydrates (58–80%), protein (6–13%) along with the content of amino acids, and lipids (6–16%), they are traditionally used to treat urinary disorders, increase the strength of the nervous system and circulatory system of blood, eliminate body contaminants, and treat anemia, diarrhea, rheumatism, diabetes, asthma, syphilis, gastric and hepatic disorders, astringent conditions, emetic conditions, toothache, and cough [6]. M. indica seeds (MISs) contain a variety of natural antioxidant products, including minerals (calcium, magnesium, potassium, salt, phosphorus, iron, manganese, and zinc), phenolic compounds, carotenoids,

vitamin C, and phenolic acid. Certain substances, including tannin (20.7%), gallic acid (6%), coumarin (12.6%), caffeic acid (7.7%), vanillin (20.2%), mangiferin (4.2%), ferulic acid (10.4%), and cinnamic acid (11.2%), were measured by HPLC analysis [7].

2. MATERIALS AND METHODS

2.1 PLANT MATERIAL AND EXTRACTION

The bark of *Mangifera 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 *Mangifera indica* (mango tree) was collected from Durgapur (W.B) India in November 2023. The plant materials were identified and verified by ICFRE- Himalayan forest research institute. After collection, the bark was washed to remove impurities, dried in the shade to preserve its constituents, and ground into a fine powder for extraction purposes. Powdered bark was extracted with methanol 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.

2.2 EXPERIMENTAL ANIMALS

Swiss albino mice (20–25 g) of either sex were housed under standard laboratory conditions with free access to food and water. All experimental procedures were conducted in compliance with the 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).

2.3 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 (*Mangifera indica* + Reserpine)**:
   - *Mangifera indica* extract 100 mg/kg, p.o.
   - After 1 hour → Reserpine 5 mg/kg, i.p.

2.4 BEHAVIORAL MODELS

- **Forced Swim Test (FST):** Duration of immobility were noted to assess depressant like activity[8] .
- **Tail Suspension Test (TST):** Immobility time were recorded as an indicator of depression-like behaviour [8]
- **Elevated Plus Maze (EPM):** Time spent in open arms measured anxiolytic activity [1,6]
- **Open Field Test (OFT):** Center time and locomotion were recorded because they indicate anxiolytic activity. [8]
- **Light Dark Test (LDT) Light-Dark Box (LDB):** Time spent in the light chamber were observed was observed as a measure of anxiolytic activity [6,8] .

STATISTICAL ANALYSIS AND DATA REPRESENTATION

STATISTICAL ANALYSIS

Data were analyzed 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 *Mangifera indica* on Behavioral Parameters Groups
FST (Immobility Time) TST (Immobility Time) EPM (Open Arm Time) OFT(CenterTime) LDB(Light Chamber Time)

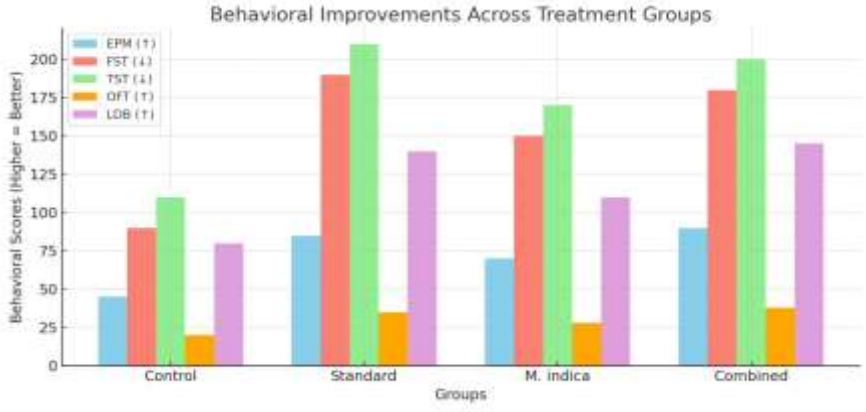
Table: 1 Comparative Analysis of Treatment Groups on Behavioral Tests

Groups	FST (Immobility Time)	TST (Immobility Time)	EPM(Open Arm Time)	OFT (Center Time)	LDB (Light Chamber Time)
Control	180 ± 10 sec	190 ± 8 sec	45.3±2.5sec	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
M. indica	150 ± 7 sec	135 ± 5 sec	70.2±2.8sec	28.3 ± 2.1 sec	110.2 ± 4.6 sec

COMPARATIVE ANALYSIS OF TREATMENT GROUPS ON BEHAVIORAL TESTS

1. **Mangifera indica significantly reduced immobility time** in both the Forced Swim Test (FST) and Tail Suspension Test (TST), indicating **antidepressant-like activity**, though it was less effective than the standard drug.
2. In the **Elevated Plus Maze (EPM)**, *M. indica* increased the open arm time compared to control, suggesting **anxiolytic potential**, though still less than the standard group.
3. **Center time in the Open Field Test (OFT)** and **light chamber time in the Light-Dark Box (LDB)** were both increased with *M. indica* treatment, supporting its **anxiolytic effects**.
4. While *M. indica* showed **moderate efficacy**, it was consistently **more effective than the control** but **less effective than the standard drug** across all behavioral tests.
5. These findings indicate that *Mangifera indica* possesses both **antidepressant and anxiolytic properties**, making it a promising candidate for further investigation.

Graphical representation



Graphical I representation of behavioral improvement across treatment group

RESULT

The graph clearly illustrates that both the standard treatment and Mangifera indica bark extract significantly enhance behavioral outcomes in animal models of depression and anxiety. The standard treatment produced the most pronounced improvements across all behavioral tests, showing increased activity in the elevated plus maze, open field test, and light-dark box, along with decreased immobility in the tail suspension and forced swim tests. While Mangifera indica extract also led to notable improvements in these tests, its effects were slightly less pronounced than those of the standard treatment. These results highlight the therapeutic potential of Mangifera indica bark extract in alleviating anxiety- and depression-like behaviors. Both treatment groups outperformed the control, reinforcing the extract's potential anxiolytic and antidepressant properties.

4. DISCUSSION

The anxiolytic effect of *M. indica* bark extract may be attributed to the modulation of GABAergic pathways[6] , while the antidepressant activity could be due to its monoamine-regulating and antioxidant properties[2,3,4,5] . The findings support traditional claims and highlight the potential of *M. indica* bark as a natural therapeutic agent [6,7,10] . The findings of our study suggest that Mangifera indica bark extract possesses notable antidepressant and anxiolytic properties. The extract significantly reduced immobility time in the Forced Swim Test (FST) and Tail Suspension Test (TST), which are established models for assessing antidepressant activity. Additionally, anxiolytic effects were evident in elevated plus maze and open field tests, where treated groups showed increased exploratory behavior and reduced anxiety indicators.

These effects are likely due to the presence of phytoconstituents such as mangiferin, flavonoids, saponins, and tannins, which may modulate neurotransmitter systems like serotonin, dopamine, and GABA. Mangiferin, in particular, has been previously reported to have neuroprotective and mood-stabilizing effects, supporting the current findings.

Compared to standard drugs, the extract demonstrated promising efficacy with potentially fewer side effects, reinforcing its traditional use in herbal medicine for managing stress-related disorders.

5. CONCLUSION

The present study demonstrates that the bark extract of *Mangifera indica* exhibits significant antidepressant and anxiolytic activities in preclinical models. The extract showed dose-dependent effects, comparable to standard pharmaceutical agents, suggesting its potential role in modulating central nervous system activity. The observed effects may be attributed to the presence of bioactive phytochemicals such as polyphenols, flavonoids, and tannins, which are known to influence neurotransmitter systems involved in mood regulation.

These findings support the traditional use of *Mangifera indica* in managing neuropsychiatric conditions and provide a scientific basis for its development as a natural therapeutic agent. However, further studies are necessary to elucidate the exact mechanisms of action, isolate active constituents, and evaluate long-term safety and efficacy through clinical trials.

Acknowledgement

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Ethical approval

All experimental procedures were conducted in compliance with the 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).

Conflict of interest

No conflict of interest was found.

REFERENCES

1. Ishola IO, Awodele O, Eluogu CO. Potentials of *Mangifera indica* in the treatment of depressive anxiety disorders: possible mechanisms of action. *J Complement Integr Med.* 2016;13(3):275–87.

2. Lei LY, Wang RC, Pan YL, Yue ZG, Zhou R, Xie P, Tang ZS. Mangiferin inhibited neuroinflammation through regulating microglial polarization and suppressing NF-κB, NLRP3 pathway. *Chin J Nat Med.* 2021;19(2):112–9.
3. Feng M, Wei S, Zhang S, Yang Y. Anti-inflammation and anti-pyroptosis activities of mangiferin via suppressing NF-κB/NLRP3/GSDMD signaling cascades. *Int J Mol Sci.* 2022;23(17):10124.
4. Yi, L.-T.; Li, C.-F.; Zhan, X.; Cui, C.-C.; Xiao, F.; Zhou, L.-P.; Xie, Y. Involvement of monoaminergic system in the antidepressant-like effect of the flavonoid naringenin in mice. Prog. Neuro-Psychopharmacol. Biol. Psychiatry 2010, 34, 1223–1228,
5. Leonard, B. E. Stress, norepinephrine and depression. J Psychiatry Neurosci. 2001, 26, S11
6. Kittiphoom, S. Utilization of mango seed. Int. Res. J. 2012, 19, 1325– 13353Utilization of mango seed Kittiphoom, S.International Food Research Journal (2012), 19 (4), 1325-1335CODEN: IFRJAX; ISSN:1985-4668.
7. Torres-León, C.; Rojas, R.; Contreras-Esquivel, J. C.; Serna-Cock, L.; Belmares-Cerda, R. E.; Aguilar, C. N. Mango seed: Functional and nutritional properties. Trends Food Sci. Technol. 2016, 55, 109– 117,
8. Hao T, Chen C, Yang S, Li F, Zhang Q, Zhou Y, et al. Mangiferin exerts neuroprotective effects against focal cerebral ischemia in mice by regulating NF-κB signaling pathway. *Metab Brain Dis.* 2023;38:383–91.
9. Tan H, Liang D, Lu N, Zhang J, Zhang S, Tan G. Mangiferin attenuates lipopolysaccharide-induced neuronal injuries in primary cultured hippocampal neurons. *Aging (Albany NY).* 2024;16(10):8645–56.
10. Walia V, Chaudhary SK, Kumar Sethiya N. Therapeutic potential of mangiferin in the treatment of various neuropsychiatric and neurodegenerative disorders. *Neurochem Int.* 2021;143:104939.
11. Zivković J, Kumar KA, Rushendran R, Ilango K, Fahmy NM, El Nashar HAS, et al. Pharmacological properties of mangiferin: bioavailability, mechanisms of action and clinical perspectives. *Naunyn Schmiedebergs Arch Pharmacol.* 2024;397(2):763–81.
12. Jangra A, Sulakhiya K, Kumar P, Dwivedi S, Lahkar M, Baruah CC. Protective effect of mangiferin against lipopolysaccharide-induced depressive and anxiety-like behaviour in mice. *Eur J Pharmacol.* 2014;744:124–31.
13. Zhang Q, Yan Y. The role of natural flavonoids on neuroinflammation as a therapeutic target for Alzheimer's disease: a narrative review. *Neural Regen Res.* 2023;18(12):2582–91.
14. Liu JJ, Wei F, Wang YD, Liu J, Xu BL, Ma SC, Yang JB. Natural polyphenol mangiferin delays neuronal cell senescence by inhibiting neuroinflammation mediated by microglial activation. *Phytomedicine.* 2025. Online ahead of print.