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Anxiolytic Activities of Ethanol Extracts of *Ficus benghalensis L* and *Morinda lucida* Benth Leaves in Mice

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Abstract

Anxiety disorders are among the most prevalent neuropsychiatric conditions globally and are often managed using benzodiazepines and selective serotonin reuptake inhibitors (SSRIs), which are associated with side effects and dependency risks. *Ficus benghalensis* and *Morinda lucida* are medicinal plants used in folk medicine to manage anxiety disorders. This study evaluated the anxiolytic properties of ethanol extracts of *Ficus benghalensis* and *Morinda lucida* leaves in mice. The extracts were subjected to phytochemical analysis using standard methods. The anxiolytic potential of the extracts was evaluated using the elevated plus-maze (EPM). The parameters monitored were the frequency of open arm entries, time spent in the open arm, and activity index (AI). Phytochemical analysis revealed the presence of alkaloids, flavonoids, saponins, tannins, glycosides, and phenols in the ethanol leaf extracts of *F. benghalensis and M. lucida*. The extracts significantly ($P < 0.05$) increased both the frequency of entries and time spent in the open arms of the elevated plus maze (EPM) at 200 and 400 mg/kg compared to the control group.

Keywords: *Ficus benghalensis*, *Morinda lucida,* Anxiolytic activities, Phytochemical Constituent

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Introduction

Anxiety is a mental health condition characterized by intense, excessive, and persistent worry and fear about everyday situations, which may occur as a response to real or perceived threats (Akinpelu *et al*., 2022**).** Although temporary anxiety is a natural behavior in humans, prolonged or severe episodes can disrupt normal functions and lead to significant deterioration in quality of life. Some common symptoms include restlessness, mood irritation, lack of concentration, muscle tension, fatigue, and sleep problems. Anxiety causes general physiological reactions that exceed mental agony. This condition often results in obvious physical symptoms such as muscular contraction, rapid beating of the heart, excessive sweating, and involuntary tremors attributed to the internal fight-or-flight response system, the body's primal defense position against perceived danger. (Szuhany and Simon 2022). Treatment for anxiety disorders typically involves a combination of therapy, medication, lifestyle modifications, and support strategies. (Bandelow *et al*., 2022). However, most anxiolytic drugs have drawbacks. Side effects, such as sedation, cognitive impairment, sexual dysfunction, and withdrawal symptoms, remain major concerns (Bruni *et al.,* 2021).

Ficus. F. benghalensis, commonly known as the Banyan tree, has demonstrated a variety of pharmacological activities, which have drawn significant attention from the scientific community. Various studies have shown that the leaves possess antioxidant, antimicrobial, anti-inflammatory, and antidiabetic activities (Kumar *et al*., 2017; Patel *et al*., 2018; Sharma *et al*., 2019; Akinmoladun *et al*., 2020). Leaf extracts have demonstrated significant wound-healing potential owing to their regenerative properties (Sharma *et al*., 2016).

Morinda lucida is a medium-sized, evergreen shrub that typically grows in the tropical and subtropical regions of West Africa, including Nigeria, Ghana, Ivory Coast, and Senegal. It thrives in lowland rainforests, secondary vegetation, forest edges, and sometimes in savannah woodlands. *M. lucida* is a highly valued medicinal plant in West African ethnopharmacology. Its traditional applications in treating diverse illnesses have spurred intensive pharmacological research. It is well known for its potent antiplasmodial activity, particularly against *Plasmodium falciparum and Plasmodium berghei* (Tran *et al.,* 2022). It reduces oxidative stress by neutralizing reactive oxygen species (ROS), which contribute to inflammation, cancer, and neurodegeneration (Ayertey *et al.,* 2021), and has been reported to regulate blood glucose levels, improve glucose tolerance, and enhance insulin sensitivity (Olajide *et al.,* 1999). *M. lucida* has shown broad-spectrum activity against several bacterial and fungal pathogens and significant anti-inflammatory effects in formalin-induced paw edema and tail flick models in rodents (Ayertey *et al.,* 2021; Owolabi *et al.,* 2022). Extracts of *F. benghalensis* and *M. lucida* have been reported to exhibit memory-enhancing, muscle-relaxant, and seizure-modifying effects, with no neurotoxic effects in mice. (Yadav *et al*., 2017; Patel *et al*., 2020; Hernandez *et al*., 2022; Kim *et al*., 2023). To the best of our knowledge, there have been no published reports on the effects of leaves on anxiety. Therefore, this study assessed the anxiolytic potential of *F. benghalensis* and *M. lucida* extracts using the Elevated Plus Maze (EPM) behavioral model in mice.

Materials and Methods

Collection and identification of plant

The leaves of *F. benghalensis* and *M. lucida* were collected in November 2024 at the Crown Estate, Igbinedion University Okada, Ovia North East Local Government Area of Edo State, Nigeria. The plants were identified and authenticated by Dr. M.A. Adebayo of the Department of Pharmacognosy, College of Pharmacy, Igbinedion University, where voucher number IUO/25/415 was obtained**.** The plant materials were dried at room temperature in the laboratory for approximately three weeks and then ground into a fine powder using mechanical milling machines.

Extraction of plant material

Powdered leaves (1 kg) of each plant were separately extracted with 80% ethanol and 20% water for 72 h using maceration. The mixture was filtered using a Buchner funnel with cotton wool, and the filtrates were left to stand for two weeks at room temperature to allow the ethanol to evaporate.

Phytochemical screening of **extracts**

The extracts were subjected to phytochemical analysis to identify its chemical constituents, following the methods described by (Sofowora, 1993: Adebayo *et al*. 2012)

Drugs and Chemicals

Diazepam (Roche, Basel, Switzerland), dimethyl sulfoxide (DMSO) (Sigma Louis, MO, USA), and normal saline (Unique Pharmaceutical Limited, Lagos, Nigeria) were used in this study. Plant extracts were dissolved in 3% DMSO and diluted to the required volume with normal saline. Drugs and plant extracts were freshly prepared for the experimental procedure.

Animals

Twenty-five male mice (18–25 g) were used. The mice were bred and housed at the Central Animal House of the Igbinedion University, Okada. The animals were maintained under natural light/dark cycles. All animals had unrestricted access to drinking water and were fed a

standard commercial diet (Guinea Feeds brand, Bendel Feeds, Benin City, Edo State, Nigeria). The experiments were conducted daily between 9:00 AM and 4:00 PM. The study was approved by the university ethics committee (IUO/ ETHICS/ 059 /05).

Experimental design

The anxiolytic potential of the extracts was investigated following the method described by Adebayo et al. (2020). Twenty-five adult male mice were randomly divided into five groups (n = 5). The extracts of *F. benghalensis* and *M. lucida* were separately tested as follows: Group 1 (normal saline 10 mL/kg), Group 2 (extract 100 mg/kg*),* Group 3 (extract 200 mg/kg), *Group 4* (extract 400 mg/kg), and Group 5 (diazepam 1 mg/kg, i. p.). The rats were orally administered the drug using an orogastric tube.

Evaluation of anxiolytic effect of extracts on elevated plus mazes (EPM)

The anxiolytic effects of the extracts of *Ficus benghalensis* (EFB) and *Morinda lucida* (EML) were investigated as described by Johnson *et al.* (2022). One hour after oral administration of EFB and EML at doses of 100, 200, and 400 mg/kg, the mice were placed individually at the center of the Elevated Plus Maze (EPM), facing the open arm. The frequency of arm entries and time spent in the open arm were recorded for 5 min. The following parameters were calculated to assess animal behavior:

Percentage of Open Arm Entries (%OE**)** = [(Number of entries into the open arm / Total number of entries)] × 100

Open Arm Duration (%OD) = [(Time spent in the open arm / Total time spent on the EPM)] × 100

The Anxiety Index, which is based on the avoidance of the open arm, was calculated using the following formula: Anxiety Index = 100 – [(%OE + %OD) / 2]

Statistical Analysis

The results are presented as the mean ± standard error of the mean (SEM). Statistical comparisons between groups were performed using one-way analysis of variance (ANOVA), followed by post hoc analysis using the Tukey test. All statistical analyses were performed using GraphPad Prism 5 software (GraphPad Software, Inc., La Jolla, USA). A significance threshold of $P < 0.05$ was considered statistically significant'

Results

Extract yields

The yields obtained for the extracts were 28.4 g (2.84%) for *F. benghalensis* and 86.49 g (8.65%) for *M. lucida*.

Phytochemical constituents of the extracts

Phytochemical analysis revealed the presence of alkaloids, flavonoids, saponins, tannins, cardiac glycosides, and anthraquinines in the ethanol leaf extracts of both plant species. Terpenoids was detected in *M. lucida* alone (Table 1)

Table 1: Results of phytochemical analysis of *Ficus benghalensis and Mornda lucida extracts*

Phytochemical Constituents	*Ficus benghalensis*	*Morinda lucida*
Saponins	++	+
Tannins	++	++
Cardiac Glycosides	++	++
Anthraquinones	++	++
Flavonoids	+	++
Steroids	+	+
Alkaloids	+	++
Terpenoids	-	+

Key; Positive = (+), Highly Positive = (++), Negative = (-)

Effects of the extracts on the open arm avoidance index (anxiety index) in mice

Both extracts at 200 and 400 mg/kg significantly ($P < 0.05$, $P < 0.001$) decreased the level of anxiety when compared with the control group (Figure 1). The effects of both extracts at 100 mg/kg were not statistically significant ($P > 0.05$) from the control group.

Effects of the extracts on open arm entries (EPM) in mice

Oral administration of both extracts at 400 mg/kg elicited significant ($P < 0.01$, $P < 0.001$) increased in the frequency of open arm entries when compared with the control group (Figure 2). A similar result was obtained with diazepam (1 mg/kg).

Effect of both extracts on open arms duration in mice

Both extracts at 400 mg/kg and diazepam (1 mg/kg) significantly ($P < 0.05$) increased the duration in the open arms of the elevated plus-maze compared to the control group (Figure 3).

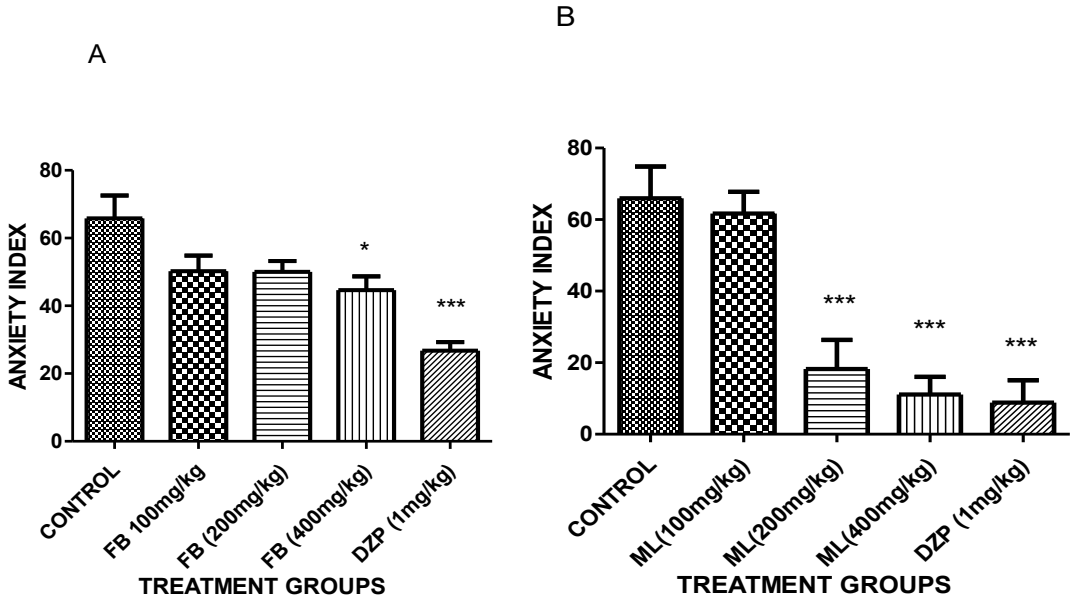

Figure 1: Effects of the ethanol leaf extracts of *Ficus benghalensis* (A) and *Morinda lucida* (B) on open arm avoidance index (anxiety index) in mice. *P < 0.05, ***P < 0.001 when compared with the control group. (n=5) FB– *Ficus benghalensis*, ML—*Morinda lucida*, DZP - Diazepam

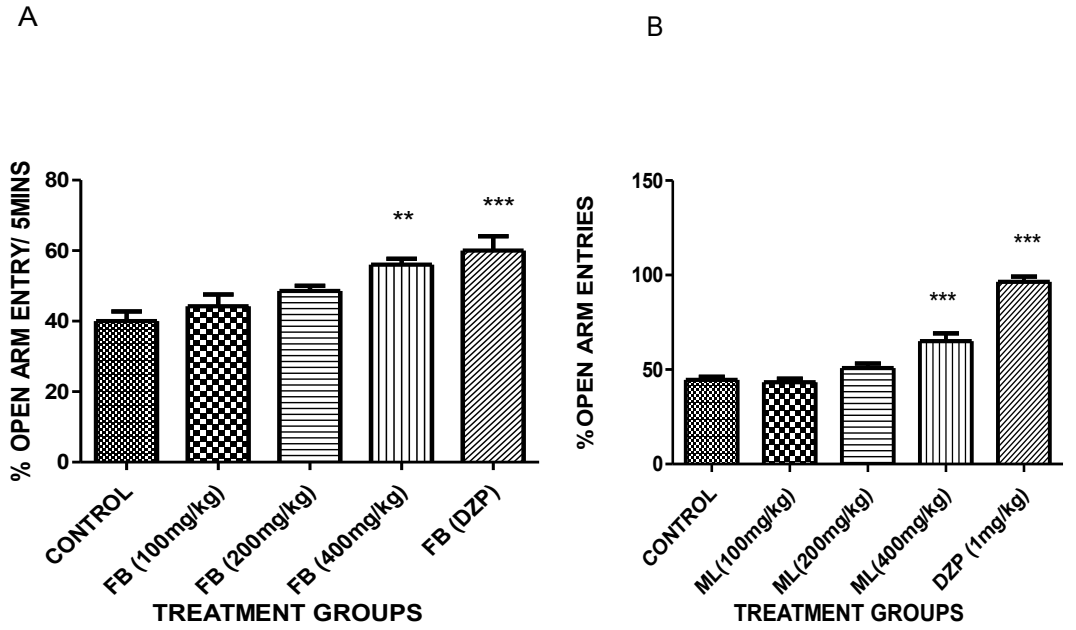

Figure 2: Effects of the ethanol leaf extracts of *Ficus benghalensis* (A) and *Morinda lucida* (B) on the frequency of open arm entries in mice. **P < 0.01, ***P < 0.001 when compared with control group. (n=5) FB– *Ficus benghalensis*, ML—*Morinda lucida,* DZP – Diazepam

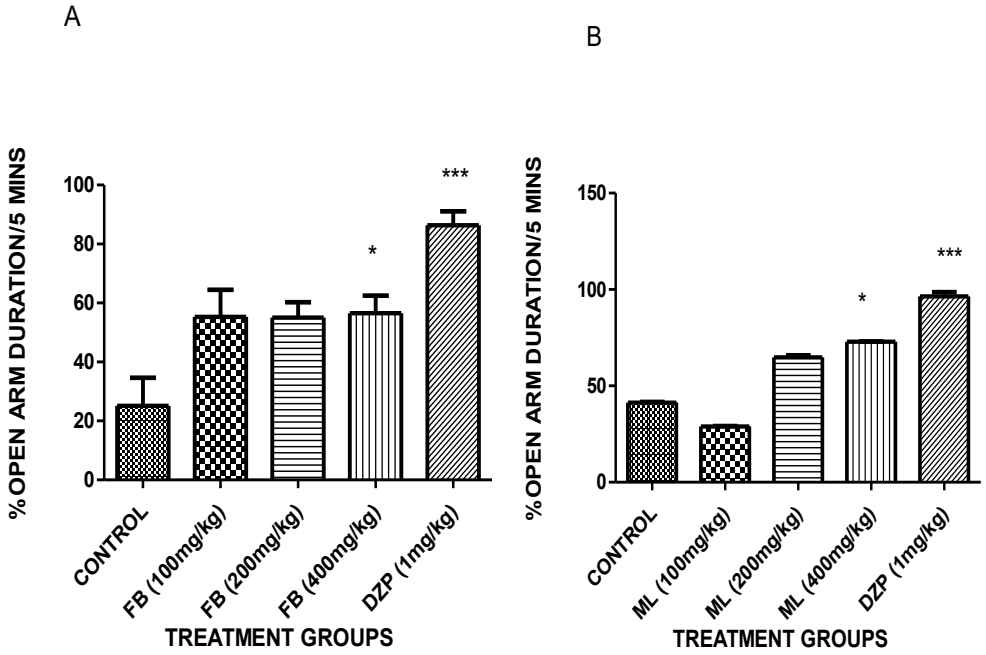

Figure 3: Effects of the ethanol leaf extracts of *Ficus benghalensis* (A) and *Morinda lucida* (B) om open arms duration in mice. *P < 0.05, ***P < 0.001 when compared with the control group. (n=5) FB– *Ficus benghalensis;* DZP – *Diazepam.*

Discussion

Phytochemical screening of the extracts of *Ficus benghalensis* and *Morinda lucida* confirmed the presence of several bioactive compounds. The elevated plus-maze test is a valid animal model of anxiety-like behavior and is based on the conflict between exploration of a new environment and aversion to enclosed spaces from which escape is prevented by a surrounding wall (Rao *et al*., 2020). Animals removed from their acclimatized cage and placed in the elevated plus maze express fear/anxiety and therefore tend to avoid the aversive center, spending more time in the protective corners and periphery (thigmotaxis) of the maze. An increase in central locomotion or time spent in the central part of the field can be interpreted as an anxiolytic-like effect, whereas a decrease in these variables is associated with anxiogenic effects (Kim *et al*., 2023).

In this study, mice treated with a higher dose of both extracts (400 mg/kg) spent more time in the central square, suggesting an anxiolytic effect similar to that of conventional anxiolytic drugs. A significant reduction in the anxiety index was observed at 400 mg/kg, suggesting decreased anxiety levels. In terms of exploratory behavior, the increased frequency of open arm entries, time spent in the open arms, and duration of time spent there are typical of anxiolytic agents acting via GABAergic or benzodiazepine-like mechanisms (Rao *et al*., 2020: Bourin, 2021).

The anxiolytic effects of both plants are in agreement with the report on plant-derived flavonoid-rich extracts and their role in anxiety modulation, demonstrating that the stem and root bark extracts of *Terminalia ivorensis*, which are also rich in flavonoids, produced significant anxiolytic effects in mice ((Adewole, *et al*., 2021). These behavioral outcomes strongly suggest the involvement of the GABAergic system, a key neurochemical pathway in anxiety regulation (Adewole, *et al*., 2021: Akinpelu *et al*., 2024) This study showed that *F. benghalensis* and *M. lucida* contain high concentrations of flavonoids; thus, their anxiolytic effects may operate through GABAergic modulation. Moreover, the replication of anxiolytic behavioral markers observed in *Terminalia ivorensis* provides a robust framework for interpreting the findings for *F. benghalensis* and *M. lucida*, reinforcing the therapeutic potential of these phytochemicals. (Johnson *et al*., 2021: Wang *et al*., 2022: Dubey & Pandey 2023). Flavonoids, such as quercetin, have been shown to interact with the benzodiazepine-binding site on GABA-A receptors, modulating their activity and contributing to anxiolytic effects (Bourin, 2021: Smith *et al*., 2023). These compounds can act as positive allosteric modulators, enhancing GABAergic neurotransmission without the conventional sedative side effects commonly associated with traditional benzodiazepines.

Conclusion

The ethanol leaf extract of *Ficus benghalensis and Morinda lucida* exhibited significant anxiolytic activity in mice potentially mediated through interaction with the GABAergic system, which can be attributed to their rich flavonoids content. These findings show that both plants may be explored for the management of anxiety and stress-related conditions.

Conflict of Interest

The authors declare no conflicts of interest.

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References.

Adebayo, MA., Okonkwo, TJN., Oladipo, AA. (2012). Phytochemical screening and antimicrobial activity of *Ficus species*. *Nigerian Journal of Pharmaceutical Sciences*, 11(2), 45-52.

Adebayo MA, Akinpelu LA, Okwuofu EO, Ibia DE, Lawso-Jack A F, Igbe I (2 0 2 0). Anticonvulsant, antiamnesic, and anxiolytic activities of methanol leaf extract of *Bambusa vulgaris* (Poaceae) in mice. *Journal of African. Association of Physiological Science* 8(2): 149-157.

Adabayo, OA., Okonkwo, CJ., Oladipo, FT. (2021). Essential oils from medicinal plants: Composition, antimicrobial and anti-inflammatory properties. *African Journal of Traditional, Complementary, and Alternative Medicines* 18(3), 144–153.

Adewole, KE., Attah, AF., & Adebayo, JO. (2021). Morinda lucida Benth. (Rubiaceae): A review of its ethnomedicine, phytochemistry and pharmacology. *Journal of Ethnopharmacology,* 276, 114055.

Akinmoladun, FO., Adewunmi, AA., Olorunsogo, OO. (2020). Ethnopharmacological survey and phytochemical screening of Ficus benghalensis in Nigeria. *Nigerian Journal of Pharmaceutical Research*, 16(2), 231–240.

Akinmoladun FO., Ogundele OM., Olayemi SO. (2023). Anxiolytic potential of *Ficus benghalensis*: Phytochemical and behavioral evaluation in mice. *Journal of Ethnopharmacology*,315,116755. https://doi.org/10.1016/j.jep.2023.116755

Akinpelu, AO., Olorunfemi, PI., Ayodele, JA. (2024). Anxiolytic and neurobehavioral effects of Terminalia ivorensis stem and root bark extracts in mice. *Journal of Ethnopharmacology*,312,116543. https://doi.org/10.1016/j.jep.2024.116543

Ayertey, F., Ofori-Attah, E., Antwi, S., Amoa-Bosompem, M.*,et al* (2021). Anti-inflammatory activity and mechanism of action of ethanolic leaf extract of Morinda lucida Benth. *Journal of Traditional and Complementary Medicine*, 11(3), 249–258.

Bandelow, B., Michaelis, S., & Wedekind, D. (2022). Treatment of anxiety disorders: *Dialogues in Clinical Neuroscience*24(1):93–107. https://doi.org/10.31887/DCNS.2022.24.1/bbandelow

Bourin, M. (2021). Mechanisms of action of anxiolytics. Psychiatry and Neuroscience Update: From Epistemology to Clinical Psychiatry IV, pp.195–211.

Bruni, O., Ferini-Strambi, L., Giacomoni, E., & Pellegrino, P. (2021). Herbal remedies and their possible effects on the GABAergic system and sleep. *Nutrients*, 13(2), 530.

Dubey P, Pandey, KB (2023). Neurotransmitter modulation by phytochemicals. Phytochemical Drug Discovery for Central Nervous System Disorders: Biochemistry and Therapeutic Effects, pp 311–325. htpps://doi.org.1002/9781119794127.ch13.

Johnson, RD., Smith, KA. (2023). Global cultivation and ecological adaptation of Ficus benghalensis. *Tropical Ecology Journal*, 64(2), 113–125.

Kumar, R., Singh, A., Prasad, S. (2017). Pharmacological profile of *Ficus benghalensis*: A review. *Asian Journal of Pharmaceutical and Clinical Research* 10(5): 80–85.

Olajide, OA., Awe, SO., Makinde, JM, Morebise, O (1999). Evaluation of the antidiabetic properties of *Morinda lucida* leaves in streptozotocin-diabetic rats. *Journal of Pharmacy and Pharmacology* 51(11): 1321–1324.

Owolabi, AO., Ndako, JA., Akpor, OB., Owa, SO., Oluyori, AP., Oludipe, OE., & Aitolo, GL. (2022). In vitro antimicrobial appraisal of the potential of *Morinda lucida* against selected bacteria. *Food Research* 6(4): 380-387

Patel, A, Patel, P. Shah, K (2020). Phytochemical constituents and pharmacological properties of *Ficus benghalensis*: A comprehensive review. *Journal of Herbal Medicine*24:100371. https://doi.org/10.1016/j.hermed.2020.100371

Rao M, Reddy B, Kumar N. (2022). Traditional uses and pharmacological activities *of Ficus benghalensis:* An updated review. *Phytochemistry Letters*, 45, 16–26. https://doi.org/10.1016/j.phytol.2022.05.008

Sharma P., Gupta R., Sharma N. (2019). Therapeutic potential of *Ficus benghalensis* in mental disorders: A review. *Asian Journal of Pharmaceutical and Clinical Research*, 12(3), 123–128.

Smith K, Johnson R, Patel A (2023). Advances in pharmacology of medicinal plants: Focus on *Ficus species*. *Medicinal Plant Research* 19(2): 88–101.

Szuhany KL, Simon NM (2022). Anxiety disorders: A review. *Journal of American Medical Association*, 328(24), 2431–2445.

Sofowora A. Medicinal Plants and Traditional Medicinal in Africa. 2 ed. Ibadan, Nigeria: Spectrum Books Ltd, 1993.

Tran L, Tam DNH, Reda A, Tahoon, AH et al (2022). A systematic review of the antimalarial activities of *Morinda* species. *South African Journal*

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