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Research Article

Effect of *Jasminum sambac* on Stress-Induced Anxiety in Mice

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Abstract

Background: Anxiety disorders are prevalent neuropsychiatric conditions that significantly impair quality of life. Although conventional anxiolytic drugs are effective, their use is limited by adverse effects, prompting the search for safer alternatives from medicinal plants. *Jasminum sambac* has been traditionally used for central nervous system disorders, but its anxiolytic potential lacks scientific validation.

Objective: This study aimed to evaluate the anxiolytic activity of the ethanolic leaf extract of *Jasminum sambac* in experimental animals.

Methods: The ethanolic leaf extract of *Jasminum sambac* was prepared and subjected to preliminary phytochemical screening. Anxiolytic activity was assessed in Swiss albino mice using the Elevated Plus Maze, Light and Dark Box, Open Field Test, and Forced Swim Test. Biochemical parameters including plasma nitrate, inducible nitric oxide synthase, acetylcholinesterase, monoamine oxidase-A and -B, and glutathione reductase were estimated. Diazepam (4 mg/kg) served as the standard drug. Data were analyzed using one-way ANOVA followed by Dunnett's test.

Results: The extract showed significant, dose-dependent anxiolytic effects, with improved behavioral parameters and normalization of biochemical markers, comparable to diazepam at higher doses.

Conclusion: The ethanolic leaf extract of *Jasminum sambac* exhibits notable anxiolytic activity, supporting its traditional use and potential as a natural anxiolytic agent.

Keywords: Anxiety disorders; *Jasminum sambac*; Elevated Plus Maze; Herbal medicine; GABAergic system; Oxidative stress.

INTRODUCTION

Anxiety disorders such as generalized anxiety disorder, panic disorder, agoraphobia, social anxiety disorder, specific phobias, obsessive–compulsive disorder, and post-traumatic stress disorder represent some of the most prevalent neuropsychiatric illnesses globally [1]. These conditions affect a substantial proportion of individuals each year and across the lifespan, accounting for a significant share of disability-adjusted life years [2]. Clinically, anxiety disorders are marked by persistent fear, worry, and somatic manifestations, including palpitations and excessive sweating. They commonly emerge during adolescence or early adulthood and occur more frequently in females than in males [3]. Owing to their negative effects on quality of life, academic performance, and occupational functioning, anxiety disorders pose a major public health challenge [4].

The pathophysiology of anxiety involves imbalances in key neurotransmitter systems, particularly gamma-aminobutyric acid (GABA), serotonin, and noradrenaline [5]. The amygdala is central to fear and emotional processing, while GABA functions as the primary inhibitory neurotransmitter in the central nervous system by decreasing neuronal excitability through GABA receptors, which are the main targets of benzodiazepines [6]. Serotonergic pathways are crucial for mood regulation, whereas noradrenergic signalling plays an important role in mediating the physiological stress response [7]. Although pharmacological therapies such as selective serotonin reuptake inhibitors, serotonin–noradrenaline reuptake inhibitors, and benzodiazepines are widely used, their clinical utility is often restricted by adverse effects.

These adverse effects, including sedation, insomnia, sexual dysfunction, gastrointestinal disturbances, tolerance, dependence, and withdrawal symptoms, can result in poor treatment adherence and highlight the need for safer and better-tolerated alternatives [8,9].

In recent years, complementary and alternative medicine has attracted increasing attention for anxiety management, with herbal therapies being particularly popular due to their accessibility, cultural acceptance, and perceived safety [10]. Medicinal plants such as *Ginkgo biloba*, *Valeriana officinalis*, and *Passiflora incarnata* have demonstrated potential anxiolytic activity through

modulation of neurotransmitter systems, although the available evidence is often constrained by methodological inconsistencies [11]. *Jasminum sambac* (Arabian jasmine or Mogra), a plant extensively used in Ayurvedic and Unani medicine, has traditionally been employed for the treatment of central nervous system disorders, including anxiety and insomnia, as well as various endocrine, gastrointestinal, and infectious conditions [12,13]. Indigenous to the Indian subcontinent and well adapted to tropical environments, *J. sambac* possesses considerable ethnomedicinal significance [14].

Phytochemical investigations have revealed that *Jasminum sambac* is rich in bioactive compounds such as flavonoids, alkaloids, terpenoids, essential oils, saponins, glycosides, tannins, and phenolic constituents. These compounds are associated with diverse biological activities, including antioxidant, anti-inflammatory, antimicrobial, and neuropharmacological effects [15]. Notably, flavonoids and alkaloids are known to influence GABAergic neurotransmission, which may provide a mechanistic explanation for the plant's traditional use as an anxiolytic [16].

Despite its widespread traditional application for anxiety relief, the anxiolytic efficacy of the ethanolic leaf extract of *Jasminum sambac* has not yet been systematically investigated. Therefore, the present study aimed to evaluate the anti-anxiety potential of the ethanolic leaf extract of *Jasminum sambac* in Swiss albino mice using the Elevated Plus Maze model, with diazepam serving as the standard reference drug. The study encompassed plant collection and authentication, preparation of the ethanolic extract through maceration, preliminary phytochemical screening, and assessment of anxiolytic activity using the Elevated Plus Maze paradigm.

MATERIALS AND METHODS

Plant Material and Extraction

The leaves of Jasminum sambac were obtained from the local market and authenticated by the Department of Botany, Dr H.S. Gour University, Sagar (M.P.).

The Jasminum sambac flower was collected and washed with water. The Jasminum sambac flower (300g) and (600ml) distilled water were placed in a round-bottom flask and connected to a Clevenger apparatus. Hydrodistillation was completed after 5 hours of boiling at a temperature of 60-100 0C. The final extract was cooled and centrifuged to separate the oil. The oil was stored in a refrigerator for further use [17].

Phytochemical Screening

Preliminary phytochemical tests were conducted per Khandelwal (2008) [18] to detect the presence of alkaloids, Flavonoids, Tannins, Phenolics, Carbohydrates, Saponins, and Steroids.

Experimental Animals

Mature Albino Mice (20–25gm) were taken from the animal house of SIPS, Sagar. All animals were kept in standard plastic polypropylene cages with stainless steel coverlids, and wheat straw was used as bedding material. The animals were maintained with a standard environment of photoperiod (12:12 hr dark: light cycle) and room temperature (23±20 °C). The animal is assisted free to feed and given purified water ad libitum. All experiments were conducted according to CPCSEA (SIPS/EC/2023/70) guidelines.

Dose Preparation

The extract was suspended in distilled water using a sonicator. Doses were 100 mg/kg and 200 mg/kg (p.o.). Diazepam (4 mg/kg, p.o.) and saline (10 ml/kg, p.o.) were prepared similarly.

Experimental Design

Table 1: Experimental Grouping, Treatments, Dosage, and Testing Schedule for the Anxiolytic Activity Study of Jasminum sambac

S. No	Group	Dosing
i.	Control Group	Vehicle Treated
ii.	Negative Control	Disease Induced
iii.	Standard	Diazepam, 4mg/kg i.p.
iv.	Test group-I	Jasminum sambac 100mg/kg
v.	Test group-II	Jasminum sambac 200mg/kg

Evaluation parameters of anti-anxiety activity:

Behavioural parameters: For evaluating the pharmacological activity of the formulation, several antianxiolytic activity tests were performed, such as the Elevated plus maze, light and dark box test, Open Field Test, and Force swim test.

Biochemical Analysis: A few biochemical parameters, such as measurement of MAO-A and MAO-B activities, Mitochondrial fraction, Glutathione (GSH), Acetylcholine esterase, Plasma nitrite, and histopathology studies, were also conducted.

Statistical Analysis

The statistical analysis was carried out as per the standard method. Results expressed as Mean± SEM were compared with the analysis of variance (ANOVA) followed by Dunnett's test value for statistical significance.

RESULTS

Extraction Yield: Maceration yielded 3.48 g (3.48% w/w) of dark green, semi-solid extract.

Table 2: Pharmacognostic Study of the extract of *Jasminum sambac*

S. No.	Phytochemical Test of Ethanolic extract of *Jasminum sambac*	Observations	Results
1.	Test for alkaloids		
	a. Dragendroff's Test	Reddish brown ppt. Brown ppt.	+
	b. Mayer's Test	Reddish brown ppt.	-
	c. Wagner's Test	Yellow ppt.	-
	d. Hager's Test		-
2.	Test for Carbohydrates		
	a. Molisch's Test	Dull violet color Red ppt.	+
	b. Fehling's Test	Reddish ppt.	+
	c. Barfoed Test		-
3.	Test for Glycosides	No change No change No change	
	a. Legal Test		-
	b. Baljet Test		-
	c. Keller killiani's Test		-
5.	Test for Flavonoids		
	a. Alkaline reagent Test	Yellow color turn to colorless	+
		Pink color	
	b. Shinoda's Test		+
6.	Test for Saponins		
	a. Foam Test	No change	-
7.	Test for Phenols and Tannins		
	a. Ferric Chloride Test	Blue-blank ppt. Yellow ppt.	+
	b. Lead acetate Test		+

(+) Phytoconstituent present and (-) phytoconstituent absent. The extract of *Jasminum sambac* gives positive test for alkaloids, carbohydrates, flavanoids, phenols and tannins. It gives negative tests for glycosides and for saponins.

Pharmacological Screening:

Table 3: Behavioural parameters are the primary evidence to confirm the presence of anxiety as well as the anti-anxiety effect of treatments.

S.No.	Group	Elevated Plus Maze		Force Swim Test	Light & dark Test		Open Field Test	
		Time spent in Open arm (Sec.)	Time spent in Close arm (Sec.)	Time Counts in Force Swim Test (Sec.)	Time spent in Light Area (Sec.)	Time spent in Dark Area (Sec.)	No. of Squire Cross in 5 min.	No. of Rearing In 5 min.
1.	Positive control	237±5.0382	63±2.0126	76±2.2108	217± 2.3024	83± 4.2015	48±2.2450	24±5.0545
2.	Negative control	41±3.4021	260±3.2017	35±2.5421	56±2.1245	244± 2.5045	14±2.5402	39±5.2540
3.	Standard (diazepam 4mg/kg)	194± 5.1307**	106± 6.2016**	64± 3.5041**	169± 3.0554**	131± 4.2045**	38± 2.2405**	27± 5.2451**
4.	*Jasminum sambac* (100mg/kg)	118± 3.0124*	184± 5.3026*	49± 4.2401*	135± 6.0215*	165± 4.3024*	31± 2.0245*	35± 2.2405*
5.	*Jasminum sambac* (200mg/kg)	167± 2.5201**	133± 4.2103**	58± 4.240***	177± 2.3054**	123± 4.2402**	34± 2.0454**	32± 5.4545**

Values are expressed MEAN±SEM, n=6, ** = P<0.01, *** = P<0.001 when compared to the normal control group, b = ns when compared to the normal control group, a*** = P<0.001 when compared to the negative control group, c = ns when compared to the standard group. Standard: Diazepam (4mg/kg).

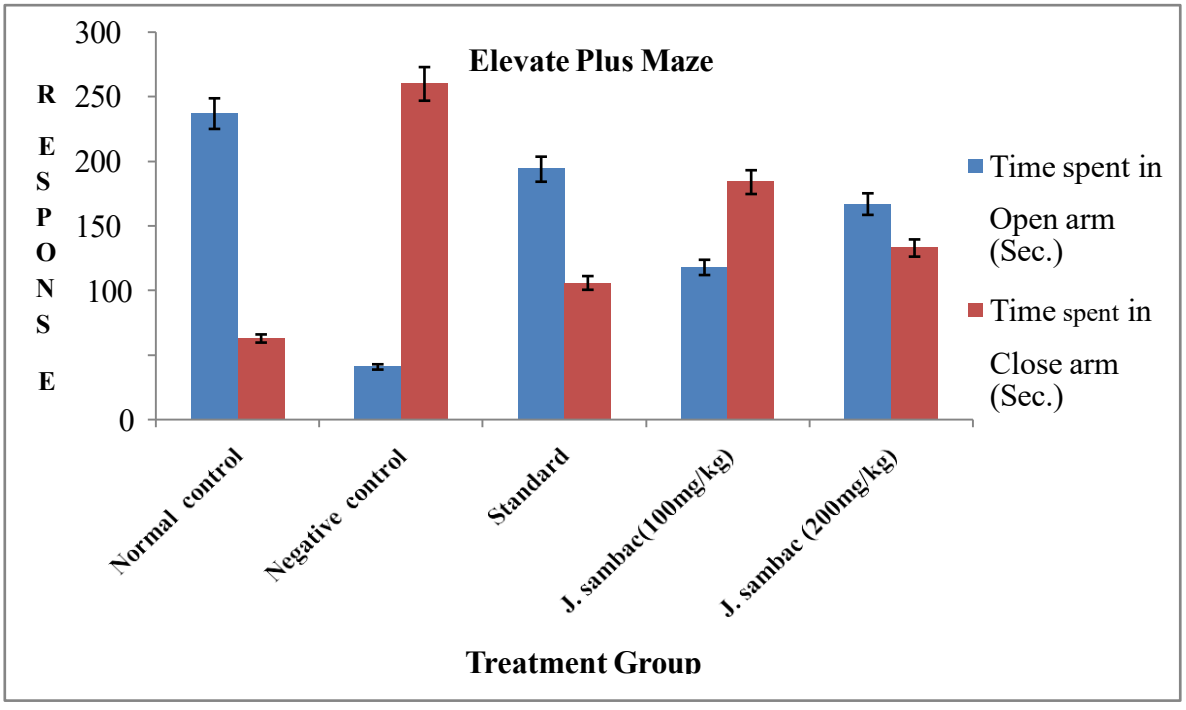


Figure 1: Effect of *Jasminum sambac* on EPM parameters in Stress-Induced Anxiety in Mice.

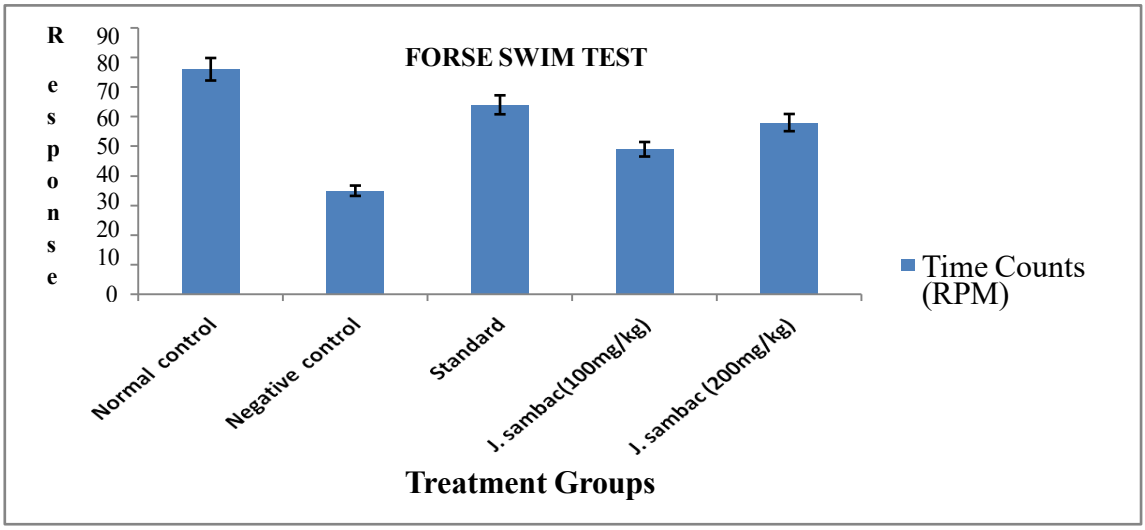


Figure 2: Effect of *Jasminum sambac* on FST in Stress-Induced Anxiety in Mice.

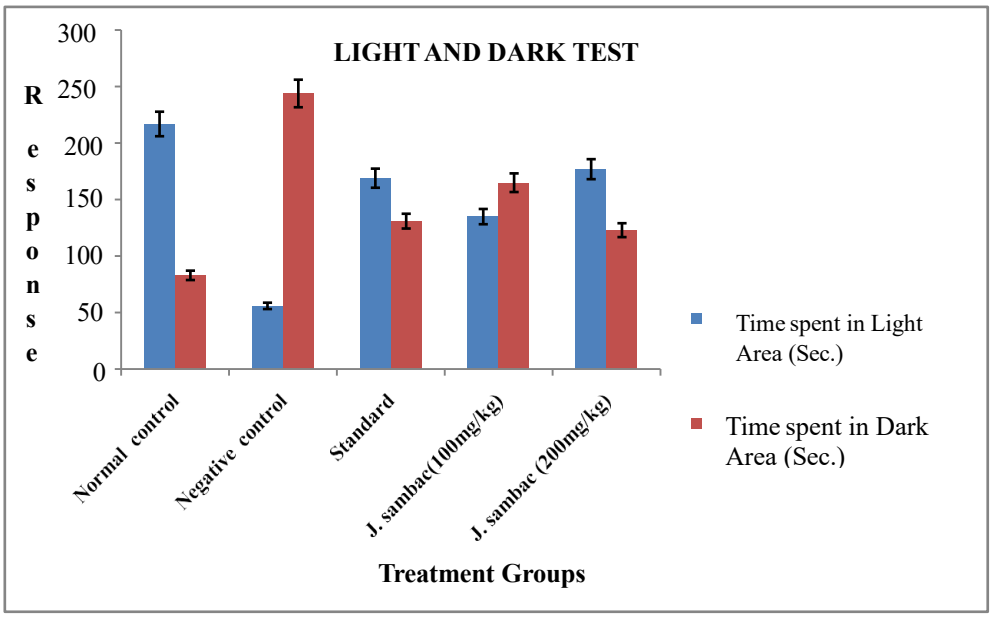


Figure 3: Effect of *Jasminum sambac* on Light and Dark Test in Stress-Induced Anxiety in Mice.

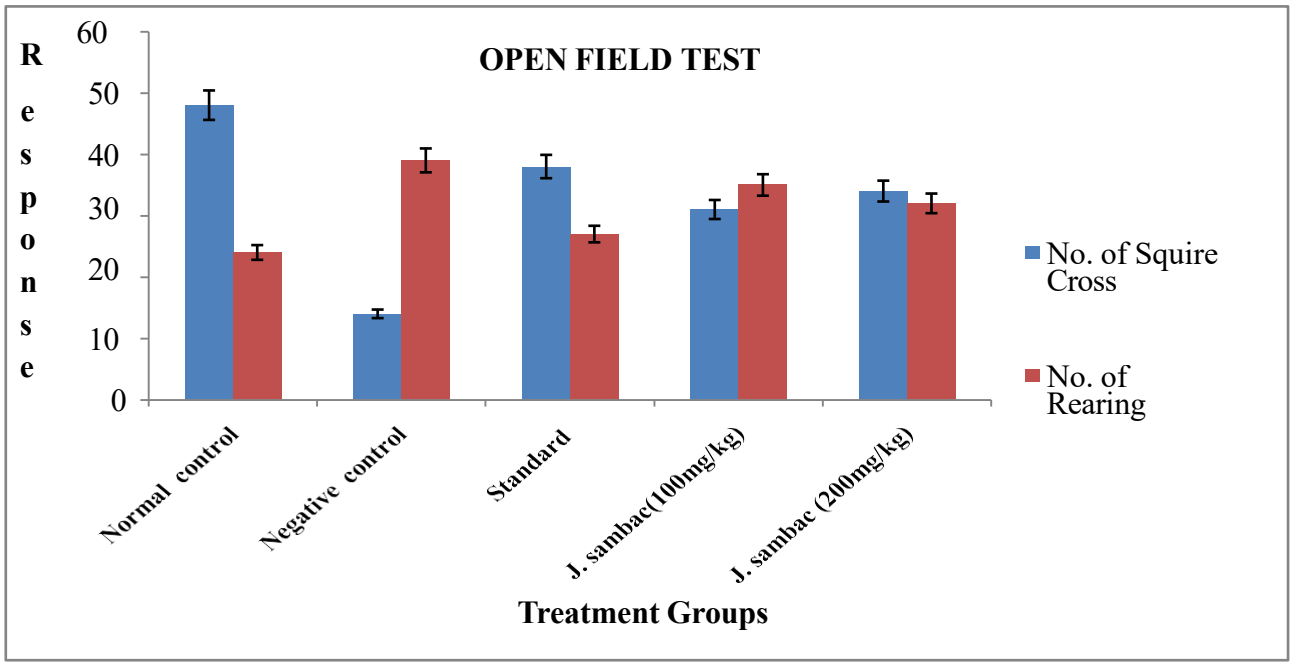


Figure 4: Effect of *Jasminum sambac* on OFT in Stress-Induced Anxiety in Mice.

Table 4: Biochemical Estimation of the studies conducted on animals in response to the treatment of different groups

S. No.	Groups	Plasma Nitrate (µmol/l) Griess assay	iNOS (µmol/l)	AchE (mg/dl)	MAO-A (U/gm protein)	MAO-B (U/gm protein)	Glutathione Reductase (U/l)
1.	Positive Control	24.38± 2.3540	103.71± 2.84550	54.31± 2.2505	64.3± 2.4024	49.8± 3.2022	1378.7± 2.2012
2.	Negative Control	73.25± 2.2405	26.23± 2.5470	81.23± 3.0245	86.1± 2.3024	73.4± 2.2061	1634.2± 2.2102
3.	Standard	48.73± 1.9058***	98.16± 2.2405***	48.72± 3.2301***	53.3± 3.2401***	43.7± 3.2102***	1426.4± 2.2015***
4.	*Jasminum sambac* 100mg/kg	61.58± 2.2405*	43.29± 3.1450*	63.17± 2.0540*	57.5± 3.2014*	48.2± 2.3045*	1624.4± 2.3201*
5.	*Jasminum sambac* 200mg/kg	53.41± 2.2450**	71.96± 2.5402**	51.92± 2.3054**	54.1± 3.3012**	45.3± 3.2015**	1483.5± 2.2230**

Values are expressed MEAN±SEM, n=6, ** = P<0.01, *** = P<0.001 when compared to normal control group, b = ns when compared to the normal control group, a*** = P<0.001 when compared to negative control group, c = ns when compared to standard group. Standard:- Diazepam (4mg/kg)

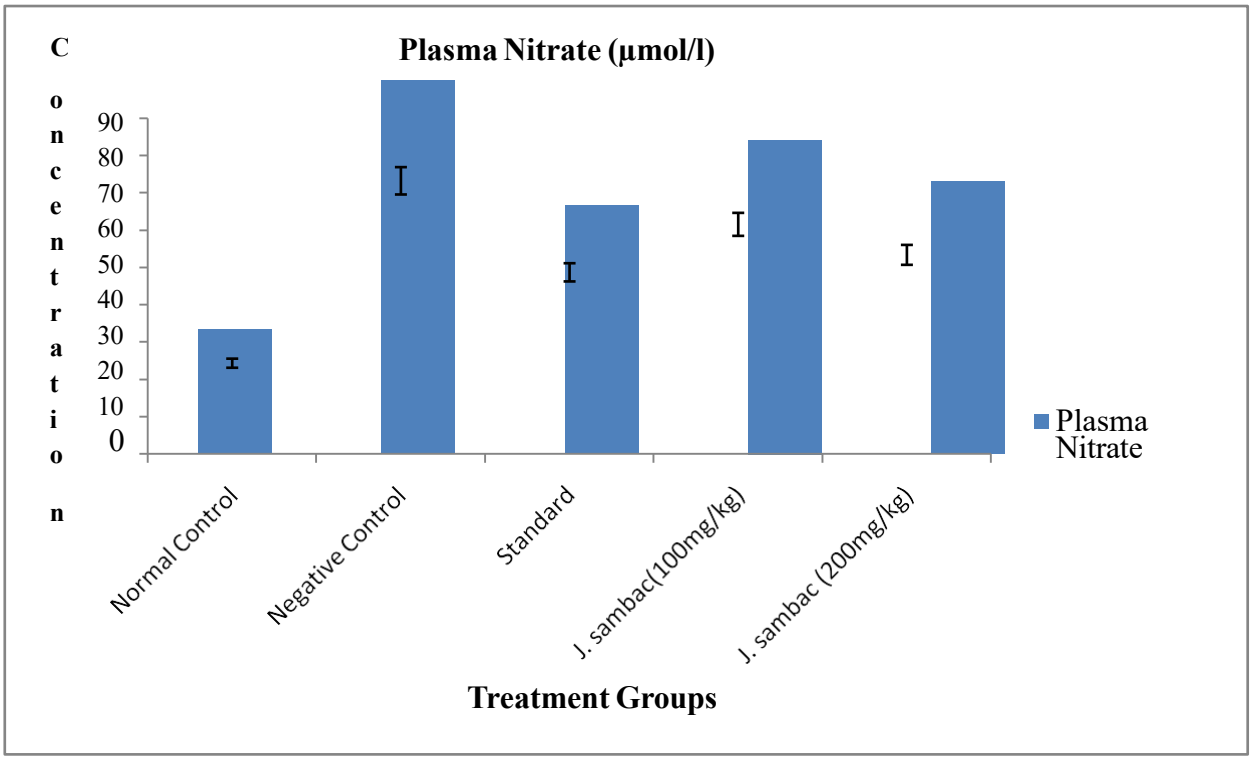


Figure 5: Effect of *Jasminum sambac* on Plasma Nitrate in Stress-Induced Anxiety in Mice.

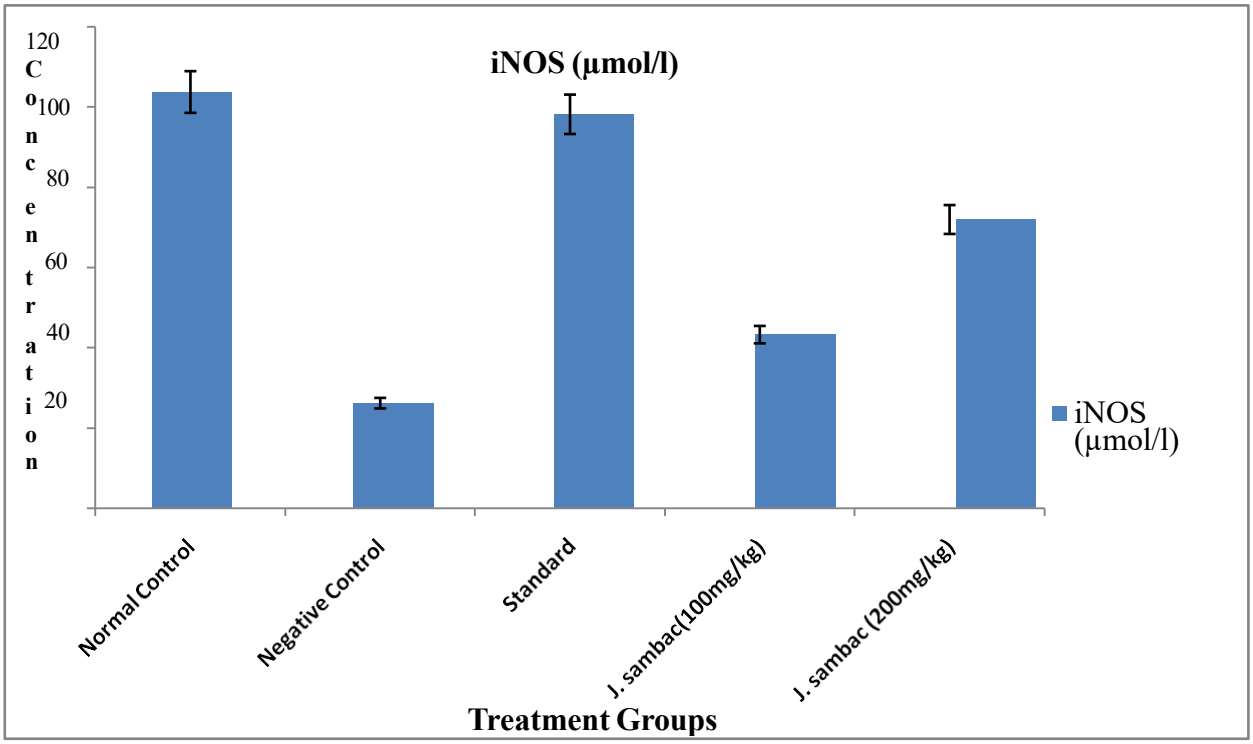


Figure 6: Effect of *Jasminum sambac* on iNOS in Stress-Induced Anxiety in Mice.

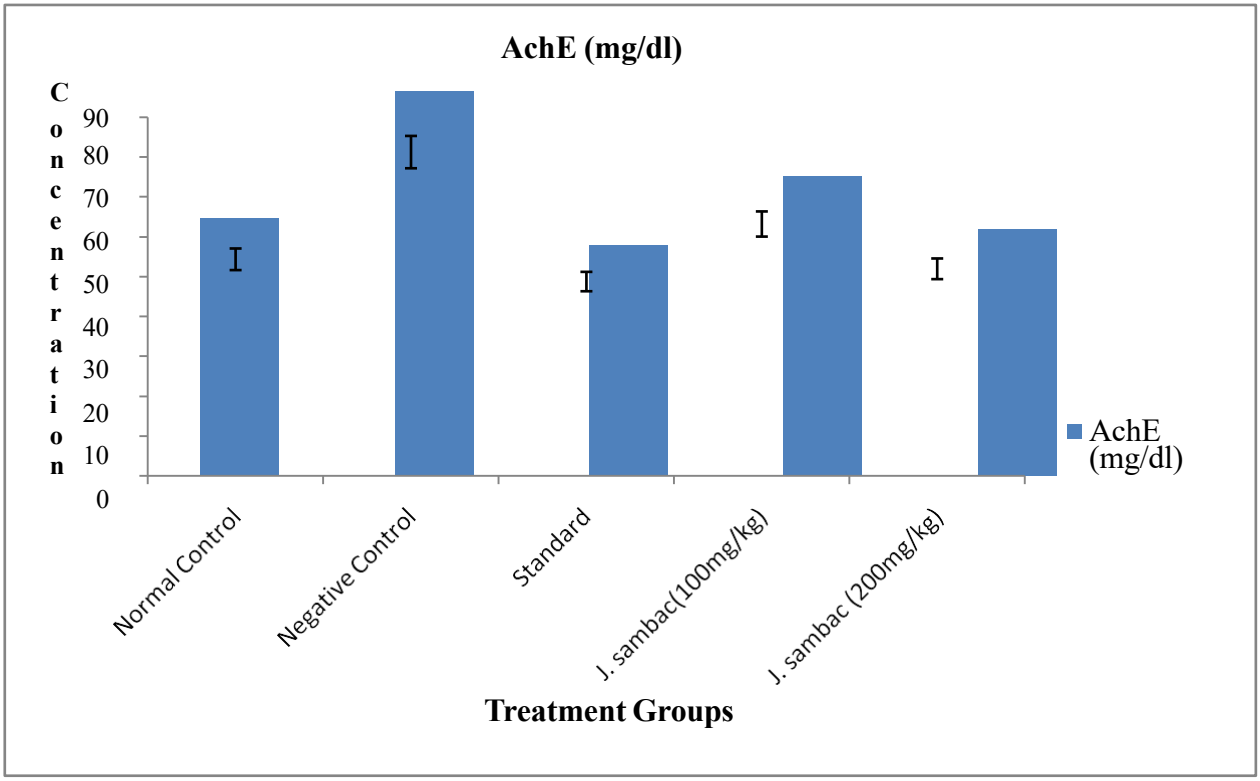


Figure 7: Effect of *Jasminum sambac* on AchE in Stress-Induced Anxiety in Mice.

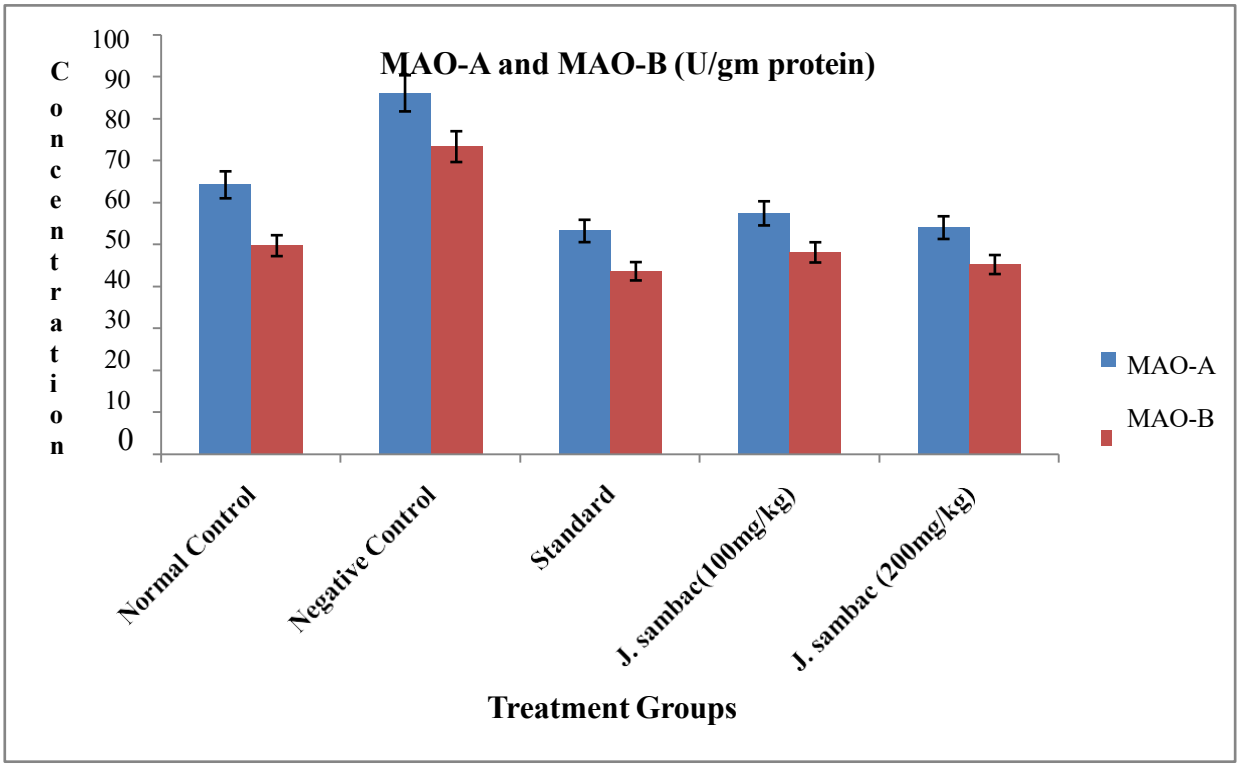


Figure 8: Effect of *Jasminum sambac* on MAO-A and MAO-B in Stress-Induced Anxiety in Mice.

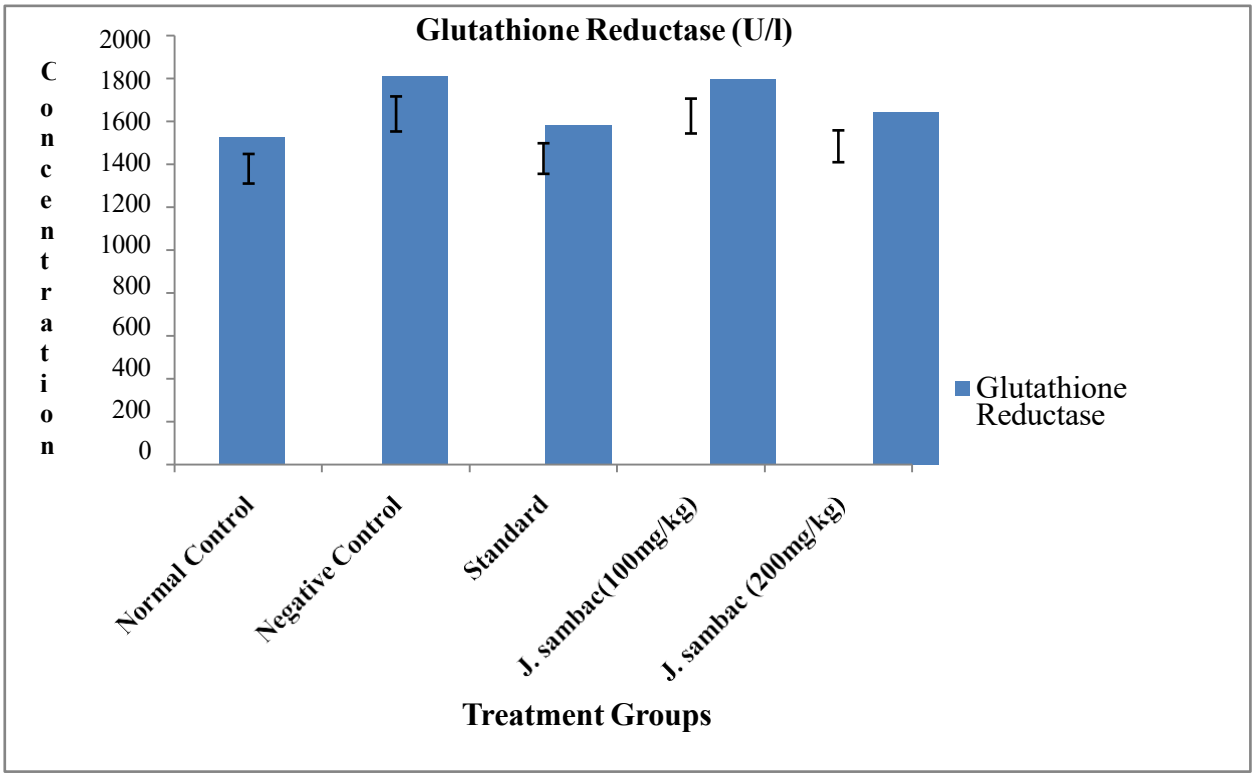
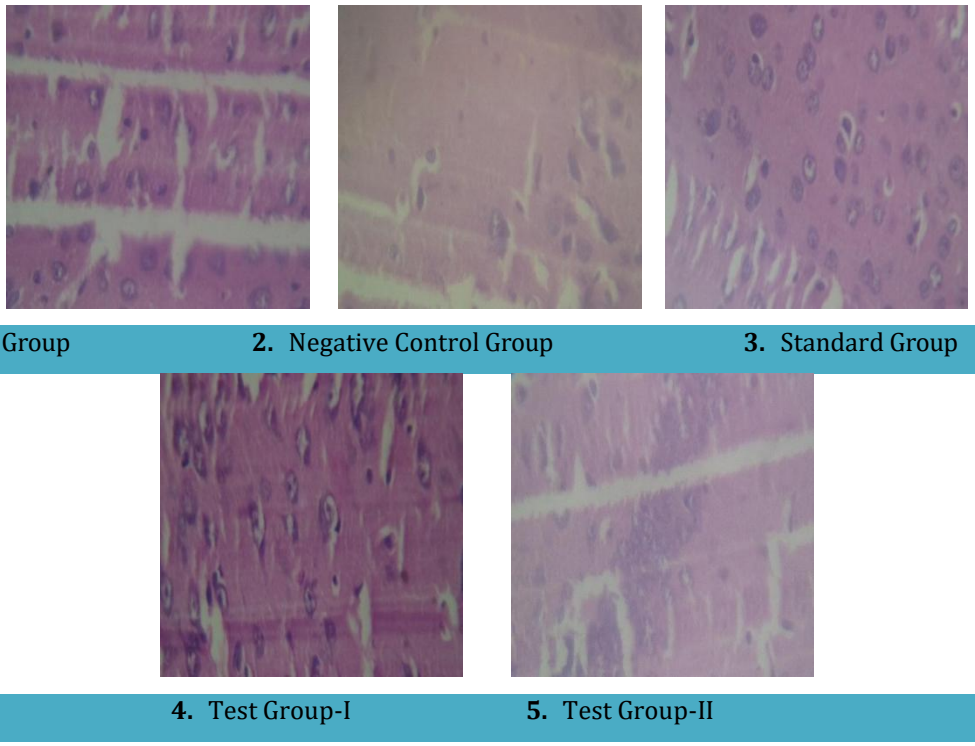


Figure 9: Effect of *Jasminum sambac* on Glutathione Reductase in Stress-Induced Anxiety in Mice.

Histopathology



1. Control Group **2.** Negative Control Group **3.** Standard Group

4. Test Group-I **5.** Test Group-II

CONCLUSION:

The present investigation provides compelling experimental evidence that the ethanolic leaf extract of Jasminum sambac exhibits significant anxiolytic activity in Swiss albino mice. Behavioral assessments using the Elevated Plus Maze, Light and Dark Box, Open Field Test, and Forced Swim Test demonstrated a dose-dependent reduction in anxiety-like behavior, with the higher dose (200 mg/kg) producing effects comparable to the standard anxiolytic drug diazepam.

Phytochemical screening revealed the presence of bioactive constituents such as flavonoids, alkaloids, phenols, and tannins, which are known to influence central nervous system function. Biochemical analyses further supported the behavioral findings by showing modulation of monoamine oxidase activity, reduction in oxidative and nitrosative stress markers, normalization of acetylcholinesterase levels, and enhancement of antioxidant defense mechanisms. These effects suggest that the anxiolytic action of Jasminum sambac may involve interactions with GABAergic and monoaminergic neurotransmission as well as antioxidant pathways.

Overall, the study validates the traditional use of Jasminum sambac in the management of anxiety and supports its potential as a safe and effective natural anxiolytic agent. Further studies involving isolation of active compounds, mechanistic investigations, and clinical evaluation are warranted to fully establish its therapeutic utility.

Conflict of interest: None.

Funding: None.

Ethical approval: All experiments were conducted in accordance with CPCSEA (SIPS/EC/2023/70) guidelines.

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