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Review Article

Anti-anxiety and anti-depressant effect of *Thymus vulgaris* on wister albino rats

Prathap Venkatesan^{*1}, Farhana Rahman², Arul Amudha Elizabeth³, Bharani Chandran⁴, Sowmya yadav⁵

^{*1}Junior resident, Department of Pharmacology, Sree Balaji Medical College and Hospital, Chennai, Tamilnadu

²Professor, Department of Pharmacology, Sree Balaji Medical College and Hospital, Chennai, Tamilnadu

³HOD & Professor, Department of Pharmacology, Sree Balaji Medical College and Hospital, Chennai, Tamilnadu

^{4,5}Junior Resident, Department of Pharmacology, Sree Balaji Medical College and Hospital, Chennai, Tamilnadu

***Corresponding author:** Prathap Venkatesan

*email id – balupratap1993@gmail.com

Abstract

Background: *Thymus vulgaris* L, commonly known as Thyme is a native of Asia and Europe. It is known for its use in traditional medicine such as respiratory disorders, anxiety, depression etc. Even though pharmacotherapy is available in the market for anxiety and depression, adverse effects of these drugs are more. Therefore, to reduce adverse effects and improve treatment efficacy, we investigate the anti-anxiety and anti-depressant activity of the herb, *Thymus vulgaris* L in animal model.

Aim: To evaluate the anti-anxiety and anti-depressant effects of *T. vulgaris* L aqueous extract in Wistar albino rats.

Methodology: Three doses (100, 150, 200 mg/kg, i.p.) of aqueous extract of *T. vulgaris* L, diazepam (1 mg/kg body weight) for anti-anxiety test and fluoxetine (10 mg/kg body weight) for anti-depressant as standard controls were administered to the albino rats. Behavioral tests such as T-Maze, light-dark box, tail suspension, and forced swim tests were evaluated.

Results: The 200 mg/kg dose significantly reduced anxiety and depressive behaviors, comparable to standard drugs. Lower doses showed moderate to mild effects.

Conclusion: *T. vulgaris* demonstrates significant anti-anxiety and antidepressant activity, supporting its potential in mood disorder treatment. Further studies are required to understand the underlying mechanism of the active compounds responsible for these pharmacological activities.

Key words: Antianxiety, anti depression, animal model

***Author of correspondence: Email:** balupratap1993@gmail.com

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Introduction

WHO defines mental disorders as, clinically significant disturbance in cognition, emotion or behavior of an individual. There are various mental health disorders, such as anxiety, depression, bipolar disorders, post-traumatic stress disorder, schizophrenia, eating disorders, disruptive behaviour and dissocial disorders, neurodevelopmental disorders etc¹. But in our present study we would be discussing only about anxiety and depression. Epidemiological data between 1990 – 2019 years were analyzed from the global burden of disease dataset related to anxiety disorders to evaluate, the prevalence, incidence, and disability adjusted life years (DALYs). It was estimated that, globally, 301 million and India with 41.8 million people were affected by anxiety disorders. According to this study, women were more likely to get affected than men, and two nodal peaks (between 10 – 14 years and 35 – 39 years of age group) were observed for the age of onset². Depression is also considered as one of the common mental disorder globally. Between 1990 – 2021, it was estimated that 280 million of the global population experience depression. Among them, 5% were < 60 years and 5.7% > 60 years of adults. Depression might lead to suicidal attack and it was observed between 15 – 29 years of age group. For India, DALYs relating to depression was estimated to be 37,487.09 per 100,000³.

Conventional pharmacological treatments for anxiety and depression includes benzodiazepines, selective serotonin reuptake inhibitors (SSRIs), serotonin and noradrenaline reuptake inhibitors (SNRI), noradrenaline and specific serotonergic antidepressant (NaSSA), noradrenaline reuptake inhibitors (NaRI) etc⁴. These drugs aims in reducing psychological and autonomic symptoms but come with adverse effects like sedation, dependency, and withdrawal symptoms. The increasing interest in natural remedies has led researchers to explore alternative therapies, including medicinal plants. *Thymus vulgaris* L commonly known as thyme, is a perennial herb belonging to the Lamiaceae family. It is native to the mediterranean region, and also widely cultivated in the Nilgiris region of Tamilnadu, India⁵. *Thymus vulgaris* is a pharmacologically versatile herb, rich in bioactive compounds such as flavonoids, phenolic compounds and phytonutrients. That's what attributes to multiple pharmacological effects of *T. vulgaris*. Various pharmacological activity includes, antioxidant, anticancer, antifungal, antiviral, antibacterial, anti-inflammatory effect etc. (Very few anti-anxiety and anti-depressant studies were done on leaf extract of *T.vulgaris* and animal model. A study done in Cameroon with aqueous extract of *T. vulgaris* showed anxiolytic, enhancement of memory and, hepatoprotective in Wister albino rats.(Both anti-anxiety and anti-depressant activity of leaves extract of *Thymus vulgaris* is sparse. Henceforth, we planned this current study of anti-anxiety and anti-depressant activity of aqueous extract of leaves of *T.vulgaris* on Wister albino rats of both gender.

Materials and Methods

Experimental Animals

The study was conducted using healthy adult male and

female Wistar albino rats weighing between 150–200 g. The animals were housed in standard polyacrylic cages at a controlled temperature (24–27°C) and humidity (60–65%), with a 12-hour light/dark cycle. Food and water were provided *ad libitum*. The experimental protocols were approved by the Institutional Animal Ethics Committee (IAEC).

Plant Extraction

Thymus vulgaris leaves were collected from verified botanical sources and authenticated at the Research laboratory in Sree Balaji medical college and hospitals. The leaves were shade-dried and ground into fine powder. Aqueous extraction was carried out using a maceration process, followed by filtration and evaporation to obtain a concentrated extract and it was titrated to a dose of 100mg/kg, 150mg/kg, 200mg/kg since 50mg/kg showed no difference in the previous study⁹. Toxicology studies shows toxicity for 2000mg/kg¹⁰.

Behavioral Assessments

1. T-Maze Test: This test measures anxiety and exploratory behavior. Each rat was placed at the start arm of a T-shaped maze and allowed to explore for a duration of 5 minutes. The apparatus consisted of one start arm and two open goal arms of equal dimensions, with all arms enclosed by 15 cm high walls and elevated 50 cm above the floor. The test measured the transfer latency (the time taken by the rat to enter one of the open arms with all four paws). Shorter transfer latency to the open arms suggests reduced anxiety¹¹.

2. Light-Dark Chamber Test: Box divided into a lit (light intensity ~400 lux) and dark compartment (covered). Animals were placed in the light side and allowed to explore for 5 minutes. Time spent in the light compartment and number of transitions. Increased time in the illuminated chamber indicates an anti-anxiety effect.

3. Tail Suspension Test (TST): Mice were suspended by the tail using adhesive tape in transparent tank in the centre for 6 minutes. Decreased immobility time reflects antidepressant-like effects.

4. Forced Swim Test (FST): Transparent tank (height 40 cm, diameter 20 cm) filled with water (25 ± 1°C, depth 30 cm). Animals were placed in water for 6 minutes; the last 4 minutes were recorded after a 2-minute habituation period.

Measurements: Immobility time. Reduced immobility indicates antidepressant activity. Reduced immobility duration suggests antidepressant activity.

The study utilized Wistar albino rats (150-200 g), divided into five groups: Control (saline), Diazepam (1 mg/kg), Fluoxetine (10 mg/kg), and *T. vulgaris* at doses of 100 mg/kg, 150 mg/kg, and 200 mg/kg administered via intraperitoneal route. The rats were kept in the safe chamber for 30 minutes. The experimental design followed standard protocols, with behavioral

assessments including the T-Maze Test, Light-Dark Chamber Test, Tail Suspension Test, and Forced Swim Test. Data analysis was conducted using one-way ANOVA with Tukey's post-hoc test (* $p < 0.05$).

Results

The results indicate a significant dose-dependent anti-anxiety and antidepressant effect of *T. vulgaris*. The 200

mg/kg dose demonstrated anxiolytic effects comparable to diazepam in both the T-Maze Test and Light-Dark Chamber Test. Similarly, the antidepressant activity observed in the Tail Suspension Test and Forced Swim Test at 200 mg/kg was comparable to fluoxetine.

The study results are detailed in the tables below, indicating the anti-anxiety and antidepressant effects of *T. vulgaris* at different doses.

Group	T-Maze Test (Latency, sec)	Light-Dark Chamber Test (Time in Light, sec)
Control	48.1 $\pm$ 2.3	80.2 $\pm$ 4.1
Diazepam (1 mg/kg)	21.4 $\pm$ 1.5 **	150.1 $\pm$ 5.0 **
<i>Thymus vulgaris</i> 100 mg/kg	39.6 $\pm$ 1.9	92.3 $\pm$ 4.5
<i>Thymus vulgaris</i> 150 mg/kg	27.2 $\pm$ 1.8 *	128.4 $\pm$ 4.8 *
<i>Thymus vulgaris</i> 200 mg/kg	23.7 $\pm$ 1.6 **	140.2 $\pm$ 4.7 **

* $p < 0.05$, ** $p < 0.01$ compared to control group.*

Group	Tail Suspension Test (Immobility, sec)	Forced Swim Test (Immobility, sec)
Control	170.6 $\pm$ 6.1	185.4 $\pm$ 5.9
Fluoxetine (10 mg/kg)	96.5 $\pm$ 4.7 **	105.8 $\pm$ 4.6 **
<i>Thymus vulgaris</i> 100 mg/kg	155.2 $\pm$ 5.6	162.9 $\pm$ 5.2
<i>Thymus vulgaris</i> 150 mg/kg	118.3 $\pm$ 4.9 *	122.1 $\pm$ 4.5 *
<i>Thymus vulgaris</i> 200 mg/kg	102.9 $\pm$ 4.5 **	108.6 $\pm$ 4.3 **

* $p < 0.05$, ** $p < 0.01$ compared to control group.*

Discussion

In 2019, WHO estimated that 970 million individuals were suffering from mental disorders such as anxiety and depression. The consequences of these disorders are huge as it leads to increase in disability and morbidity. Moreover, it causes significant economic loss of a family due to decrease in productivity of the affected individual¹⁰. From ancient time, people depends on nature or home remedies for health. It is a known fact that our modern medicine came into being on the basis of folk medicine. In the recent years, traditional medicines gain momentum because of lesser side effects. But there is lack of scientific evidence. *Thymus vulgaris* is a flowering plant which was originally found in southern Europe. Initially, this plant was used as a flavouring agent because of its strong aromatic nature¹¹. WHO has acknowledged the role of plants, their metabolites, and traditional medicine especially in the developing countries. It has created safety guidelines for the use of herbal medicine¹².

Thyme have been reported with various pharmacological activity such as anti-bacterial, anti-inflammatory, anti-fungal, etc. A study conducted on Wister albino male rats with aqueous extract of leaves of *T. vulgaris* reported both anxiolytic and memory enhancement activity. This study also shows that *T. vulgaris* herb is hepatoprotective¹³. Phytochemical constituents of thyme includes steroids, terpenoids, flavonoids, alkaloids, tannins and, saponins. This herb is also a major sources of monoterpene phenolic compounds, e.g., thymol, carvacrol, p-cymene, α -pinene, linalool, borneol and, 1, 8 cineole¹⁴. Another study investigated with thymol, a component of *T. vulgaris* reported that thymol showed anti-anxiety activity with mice when compared to vehicle (0.01% ethanol)¹⁵. (In China, a researcher reported that thymol

has an anti-depressant like effect on chronic mild stress when tested on mice¹⁶.

Our present study showed that *T. vulgaris* possesses significant antianxiety and antidepressant effects on Wister rats of both gender at 200 mg/kg dose ($p < 0.01$) and 150 mg/kg ($p < 0.05$) when compared to control (0.9% normal saline 1 mg/kg). It was comparable with experimental standard drugs, Diazepam (1mg/kg) for antianxiety and Fluoxetine (10 mg/kg) for antidepressant pharmacological action. Two experimental models were used to test for antianxiety, T – maze test and light and dark chamber test. The working principle of T – maze is to accesses spatial working memory in rats or mice¹⁷. (It was seen that the rats from the Diazepam group and *T. vulgaris* group (150 mg/kg bd wt and 200 mg/kg bd wt) were moving around the T-maze when compared with the control group, i.e; there is increased in spatial working memory of these rats. Similarly, in the dark and light chamber, it was observed that Diazepam group and *T. vulgaris* group (150 mg/kg bd wt and 200 mg/kg bd wt) rats were spending more time in the light chamber than in the darker one. This exhibits that, that is decrease in anxiety levels among these rats when compared with the control group. While testing for antidepressant activity of the extract, two experimental models were used, tail suspension test and forced swimming test. The working principle of these two model is to create a stress like behaviour. Initially the animal struggle and it becomes immobile due to depressive like behaviour. When the rats were administered standard drug for depression, Fluoxetine (10 mg/kg), and aqueous extract of *T. vulgaris* (150 mg/kg bd wt and 200 mg/kg bd wt) it was seen that, there is reduction of immobility and we could assume that *T.vulgaris* has antidepressant activity when compared with the control group. Even though it was not

statistically significant, it was observed that 200mg/kg dose showed increased antianxiety and antidepressant activity than 150 mg/kg dose. It has been assumed from various studies that thymol or carvacol16, the major phenolic component of *Thymus vulgaris* could be related to the observed pharmacological activity in our study. Further research are required to understand the mechanism of action for the pharmacological action would help in confirming potential therapeutic applications in human subjects.

Conclusion

The present study demonstrated that the aqueous extract of *Thymus vulgaris* L. exhibits significant anti-anxiety and antidepressant activity in Wistar albino rats, particularly at higher doses of 150 mg/kg and 200 mg/kg. The extract showed comparable efficacy to standard pharmacological agents—diazepam for anxiety and fluoxetine for depression—in validated behavioral models such as the T-maze, light-dark chamber, tail suspension, and forced swim tests.

These findings support the traditional use of *T. vulgaris* in mood-related disorders and suggest its potential as a natural alternative or adjunct therapy for anxiety and depression.

The dose-dependent effects observed in this study indicate that higher concentrations of the extract are more effective, which may be attributed to the presence of bioactive compounds like thymol and carvacrol. Given the rising interest in plant-based therapies and the limitations of current pharmacotherapies, *T. vulgaris* offers a promising option with a favorable safety profile. However, while the results are encouraging, further research is essential to isolate the active constituents responsible for the observed effects, understand their mechanism of action, and assess their long-term safety and efficacy. Future studies, including clinical trials in humans, will be crucial to validate these preclinical findings and explore the therapeutic potential of *T. vulgaris* in managing anxiety and depression.

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