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Kattosh (*Lasia spinosa* (L.) Thwaites) an edible vegetable improve anxiety and depression in animal model

Mohammad Sarwar Hossain, Mst Samima Nasrin and A.S.M. Ali Reza
Department of Pharmacy
International Islamic University Chittagong (IIUC), Bangladesh

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Abstract

Lasia spinosa (L.) thw is utilized in folk medication against different ailments such as diabetic, anxiety and depression. The aim of the present study was to investigate the anxiolytic and antidepression activities of hydroalcoholic extract of *Lasia spinosa* (HaE-LS) in mice model. This research investigated the effects of hydroalcoholic extract (HaE-LS) *L. spinosa* in recovery of behavioral changes through its, anxiolytic and anti-depressant impacts. The anxiolytic activity was assessed by elevated plus maze (EPM) test and hole board tests (HBT), anti-depressant effect was appraised by tail suspension tests (TST) and forced swimming test (FST). During the anxiolytic assay by elevated plus maze test, the HaE-LS significantly ($p< 0.05$) increased the time spent in the open arm 71.67 ± 4.70 sec at the dosages of 400 mg/kg. In HBT HaE-LS exhibited dose-dependent anxiolytic activity. In TST, mice swallowed with 400 mg/kg of HaE-LS demonstrated significant ($p< 0.005$) immobile time 60.33 ± 2.37 sec.In FST, the HaE-LS displayed reductions in their immobility times, which was significant 75.67 ± 2.33 sec and 61.67 ± 2.33 sec at the dosage of 200 and 400 mg/kg, respectively. Overall, the results recommend that HaE-LS could be a promising beneficial option for the treatment of anxiety and depression disorders

Corresponding author
A.S.M. Ali Reza
Department of Pharmacy, International Islamic University Chittagong, Kumira, Chattogram, Bangladesh - 4318
Email: alirezaru@gmail.com

1. Background

There are 450 million people globally affected by neurodegenerative disorders, with approximately 0.12 billion people suffering from anxiety

and depression. Consequently, depression and anxiety are regarded as the that world's leading neurological disorders (Goni et al., 2020a; Hossen, Ali Reza, et al., 2021; Reza, Rashid, et al., 2023; Uddin et al., 2018). Anxiety, depression, insomnia are psychological disorders that are responsible for disrupting the normal activity of people suffering from them. The etiologies of these psychological problems are still unclear, however, physiological problems, habitual, genetic variation, chronic diseases and poor lifestyle of the patients might be responsible for these disorders (Berton & Nestler, 2006; Rahman et al., 2020; Tareq et al., 2020). Neurological problems such as physiological and mental sickness are the leading problems around the world (Ali Reza et al., 2021; Islam et al., 2021; Rahman et al., 2020; Reza et al., 2018; Tareq et al., 2020). Numerous researches have stated that free radicals and initiation of oxidative stress are one of the leading factors in psychotic disorders (Hossain et al., 2020; Hossen, Ali Reza, et al., 2021; Moni et al., 2021; Nirmal, Babu, Harisudhan, & Ramanathan, 2008). Nevertheless this, innumerable kinds of drug, including TC antidepressants, MAO inhibitors, and SSR inhibitors, are the frequently used medicines for neuropharmacological disorders (Belmaker & Agam, 2008; Bristy et al., 2020; Tareq et al., 2020). Though, current available drugs have considerable untoward effects, including CNS dysfunction, dependency, and weight gain (Ahmad et al., 2020; Ansari et al., 2017; Pawar, Anup, Shrikrishna, & Shivakumar, 2011). Natural products are regarded as a healthier foundation of existence for all classes of peoples, and vegetable and natural nutritional resources have been commonly used due to their unlimited diversity of healing and nutritive principles for the treatment of neurological illnesses(Adnan et al., 2020; Hossen, Reza, et al., 2021; N. Islam et al., 2021; M. Rahman et al., 2021; Tareq et al., 2020).

Lasia spinosa belongs to the Lamiaceae family as well as locally known as khattosh. It is an evergreen, herbaceous perennial plant growing 1 - 2 meter's tall, spreading by means of a long, creeping, stoloniferous stem (Li, 2007). The plant is collected from the wild for its edible rhizomes and various medicinal uses (Brach & Song, 2006; M. S. Islam et al., 2021; Uphof, 1959).The rhizomes are utilized restoratively for treating lymph tuberculosis, lymphonoditis, stomach hurts, snake and creepy crawly chomps, wounds, and rheumatism (Chopra, Nayar, & Chopra, 1986). Moreover, the rhizomes are used to treat throat diseases (Chopra et al., 1986). Although the herb has many significant therapeutic benefits but the therapeutic assessment of this herb is still scientifically not up to date to support neurological disorders. Hence, the current study has been designed to investigate and to provide scientific basis of *Lasia spinosa* (L.)

Thw. a known edible vegetable for its anxiolytic, anti-depressive properties.

2. Methods

2.1. Preparation of crude extract

Fresh rhizomes of *Lasia spinosa* plant are purchased from local bazar, Sitakunda, Chittagong, Bangladesh, which later authenticated by Professor Dr. Sheikh Bokhtear Uddin, Department of Botany, University of Chittagong. The details description of the hydroalcoholic extract (HaE-LS) preparation was followed by the method described earlier (Reza et al., 2021a; Reza, Sakib, et al., 2023).

2.2. Experimental animals and Study protocol

The male Swiss albino mice aged between 5-6 weeks and weighing 25-30 g were used in our study. The animals were grouped and acclimatized according to methods described by Hoque *et all* (Hoque et al., 2021).

2.3. Anxiolytic activity

2.3.1. Elevated plus maze (EPM) test

The EPM test was accomplished according to the methods described by Barua and Goni *et all* (Barua, Talukdar, Begum, Borah, & Lahkar, 2012; Goni et al., 2020b).

2.3.2. Hole-board test

The test was performed according to the method described earlier by Barua and Goni *et all* (Barua et al., 2012; Goni et al., 2020b).

2.4. Antidepressant activity

2.4.1. Tail suspension test (TST)

The tail suspension test (TST) was performed by the methods described previously Khan *et all.* (Khan et al., 2020; Steru, Chermat, Thierry, & Simon, 1985).

2.4.2. Forced swimming test (FST)

The forced swimming test (FST) was performed using the method described earlier by Khan and Porsolt *et all.* (Khan et al., 2020; Porsolt, Le Pichon, & Jalfre, 1977).

2.5. Statistical analysis

The data were presented as mean ± standard error of mean. One-way analysis of variance (ANOVA) followed by Dunnet's test was used to describe the data for significant differences between the test and control groups using GraphPad Prism Data Editor for Windows, Version 6.0

(GraphPad software Inc., San Diego, CA). P values (<0.05 and < 0.01) were considered as statistically significant.

3. Results

3.1. Anxiolytic activity

3.1.1. Elevated plus maze test (EPM)

In the EPM, control-treatment mice spent 47.67±2.33 (s) in the open arms and 131.33±3.48 (s) in the closed arms, whereas HaE-LS extract 200 mg/kg spent 71.67±4.63 & 229± 5.2 sec& 400 mg/kg treatment mice spent 64.33±4.70 & 237.33 ± 3.93 sec time open and closed arms respectively. In diazepam 1 mg/kg also increased the time spent in open arms and decreased the time spent in closed arms 128.33±2.73 & 68.67±3.28 seconds respectively. All data and results are represented in the Figure 1.

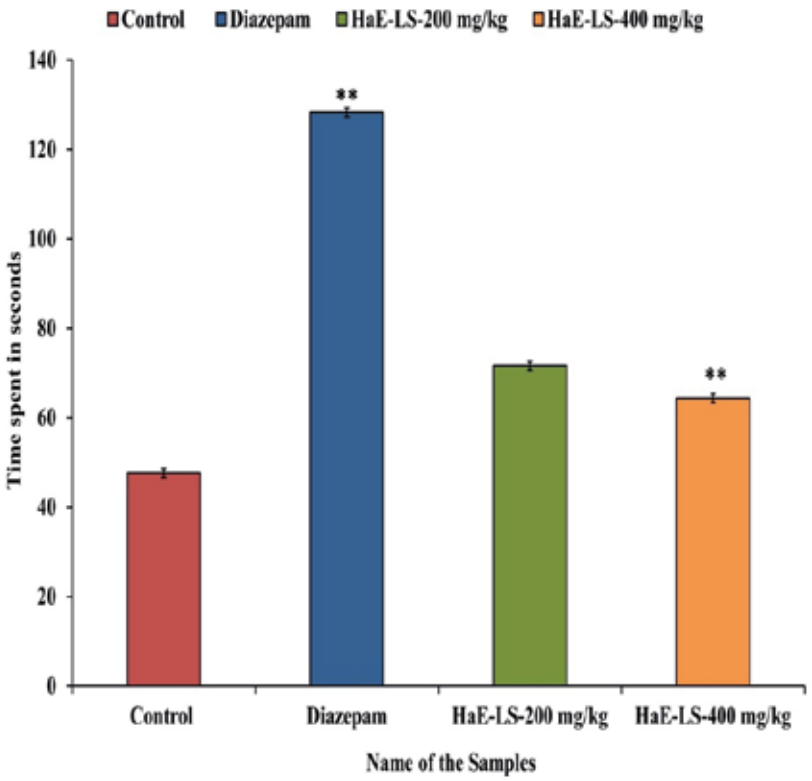

Figure 1

Anxiolytic activity of hydro-alcoholic extract of rhizome of *Lasia spinosa* on elevated plus-maze test in mice. Values are mean ± S.E.M. **p<0.01, significantly different from control; ANOVA followed Dunnett's test.

3.1.2. Hole-board test (HBT)

In hole board neuro-pharmacological test two doses 200mg/kg b.w and 400mg/kg b.w is administered and treatment mice head dipping number was decreased significantly compared with the control treatment mice. Standard drug diazepam treatment mice give least number of head dipping. HaE-LS 200mg/kg and 400mg/kg treatment mice give 37.67±0.88 & 29.33±1.86 number of head dipping respectively, where the control treatment mice head dipping number is 75.67±1.20. HaE-LS head dipping number can be compared with standard diazepam treatment mice whose head dipping number is 12.33±0.88. Results are shown in Figure 2.

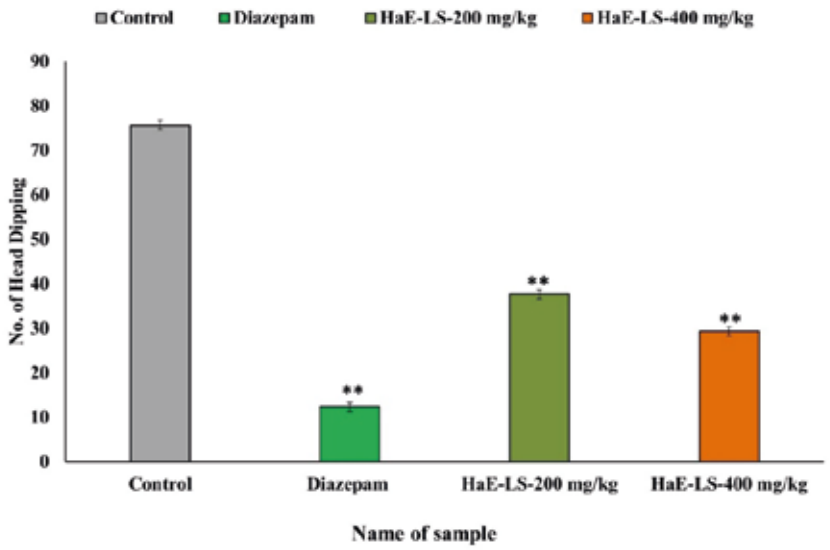

Figure 2

*Anxiolytic activity of hydro-alcoholic extract of rhizome of Lasia spinosa on Hole-board test in mice. Values are mean ± S.E.M. **p<0.01, significantly different from control; ANOVA followed Dunnett's test.*

3.2. Antidepressant activity assay

3.2.1. Tail suspension test (TST)

In TST the tested animals were treated with two doses of HaE-LS 200 mg/kg and 400 mg/kg, doses showed decrease in their immobility times, which were significant 84.67 ± 3.93 second and 60.33 ± 2.37 second respectively when compared with control 160.33 ± 1.18. Similarly, the tested animals were treated with Fluoxetine (20 mg/kg), as expected,

showed a significant decrease in the immobility time 20 ± 1.25 seconds. Results are shown in Figure 3.

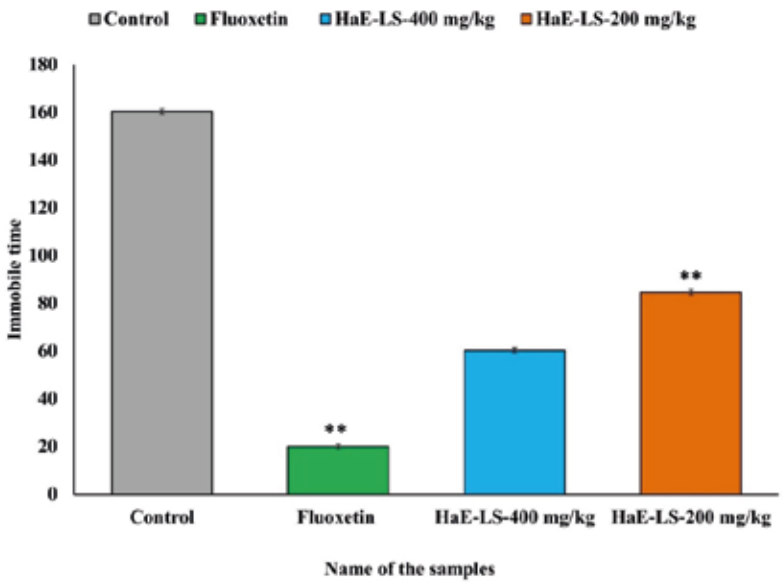

Figure 3

*Antidepressant activity of hydro-alcoholic extract of rhizome of Lasia spinosa on Tail suspension test in mice. Values are mean ± S.E.M. **p<0.01, significantly different from control; ANOVA followed Dunnett's test.*

3.2.2. Forced swimming test (FST)

In FST, the grouped mice were treated with two doses of HaE-LS 200 and 400mg/kg, both showed decrease in their immobility times, which were significant 75.67± 2.33 sec and 61.67± 2.33 sec and respectively; when compared with control 118.33 ± 1.20 sec. Similarly, when animals were treated with Fluoxetine 20 mg/kg, as expected, showed a significant decrease in the immobility time 22.67 ± 1.45 seconds. Results are presented in Figure 4.

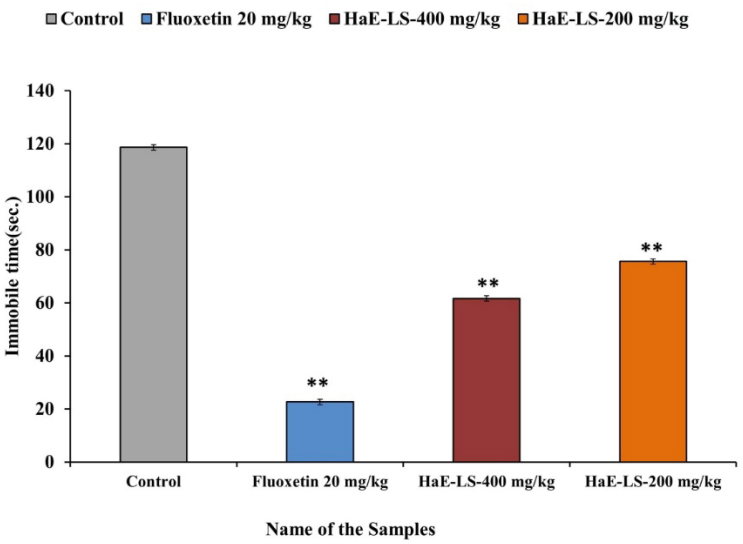

Figure 4

*Antidepressant activity of hydro-alcoholic extract of rhizome of Lasia spinosa on forced swimming test in mice. Values are mean ± S.E.M. **p<0.01, significantly different from control; ANOVA followed Dunnett's test.*

4. Discussion

The inventions of alternative pharmaceutical drugs based on natural products have been used for their therapeutic values simce prehistoric societies. Medicinal plants are widely used in the pharmaceuticals companies to prepare diverse herbal remedies, vitamins, and therapeutics for illnesses (Ahmed et al., 2021; Akter et al., 2021; Haque, Reza, Nasrin, & Rahman, 2020; Hossen, Reza, et al., 2021; M. N. Islam et al., 2020; M. Rahman et al., 2021; M. M. Rahman et al., 2021; Reza et al., 2021b). However, the plant used in this study is well known for its traditional uses, but yet has not been investigated for its different pharmacological values including CNS system. Anxiety and depression is one of the major health hazards around the globe (Adnan et al., 2020; Babar et al., 2019; Hossain et al., 2020; Tareq et al.).

Researchers gave more attention to finding out the mechanism of neurobiological basis of mood disorders, which resulted in the introduction of new medicines (Reza et al., 2018). The tail suspension method was used to evaluate the level of depression in rodents as a parameter (Pollak, Rey, & Monje, 2010). Besides, EPM and HBT tests

were performed to find out the anxiolytic activity of drugs on mice (Walf & Frye, 2007). In this study, during EPM test, the labyrinthine like maze makes them more vulnerable to spending a lot of time in closed arm instead of open arm (Saivasanthi, Swathi, & Sowmya Rani, 2011). It is an accurate approach to examine the effect of medicines on mice to evaluate if they have any possible anxiolytic effect on them (Bourin, Petit-Demoulière, Nic Dhonnchadha, & Hascöet, 2007). There, stress emerged as a consequence of the heights of the maze in which the rodents were put. Animals were treated with *L. spinosa* at the doses of 200 and 400 mg/kg that demonstrated increased percentage of number of entries into the open arms. The disinclination of staying in open by the extractives was also substantiated by the higher amount of time spent in the open arm in comparison with the negative control. This declined abhorrence to open arms is a sign of calmness and anxiety free condition in comparison to control group (Saivasanthi et al., 2011).

Moreover, all the dosage of HaE-LS also showed significant increase in the time spent in open arm as well as number of entries into open arm. Strikingly, the EPM test is also popular screening tools to investigate novel benzodiazepine like therapeutics (Akindele & Adeyemi, 2010). Subsequently, HBT was used to assess the attitude of animals to an unfamiliar situation which can predict anxiolytic-like behavior. However, most of the studies claimed that HBT is directly related to animals mind set state (Ebert, Wafford, & Deacon, 2006). The present experimental findings revealed that HaE-LS have higher tendency of head dipping at the doses of (400 mg/kg, p.o.). Anxiety arises as a result of either an abnormal activity of neurotransmitter such as serotonin, dopamine, GABA receptor or the irregularity caused by glutamatergic, serotonergic, GABA-ergic, and noradrenergic transmission (Mennini, Caccia, & Garattini, 1987). In our investigation, HaE-LS were further exposed to TST to evaluate antidepressant potential. The surroundings of TST are exceptionally upsetting, where mice shows their desperation through mobility that demonstrate the mice behavioral desperation. Nonetheless, HaE-LS (200 and 400 mg/kg) treatment in mice uncovered propellant attitudes by minimizing immobility, and expanded battling propensity in the apparatus.

These remarkable antidepressant potentials of HaE-LS might be responsible for the mitigation of monoamine reuptake in the brain. In TST and FST, the HaE-LS markedly dwindled immobility time, the activity was lower than the standard drug, fluoxetine. The degree of lessening in immobility is measured to be a respectable predictive value in the approximation of possible antidepressants (Porsolt et al., 1977). The

study demonstrated that HaE-LS revealed antidepressant-like potentials as related to the control group. Therefore, it is recommended that HaE-LS may be discovered for further options of neurological problems including anxiety and depression.

5. Conclusion

The pharmacological findings suggest that the HaE-LS may support novel therapeutic approaches in neuropsychiatric disorders, especially anxiety, depression. In this manner, *L. spinosa* may be considered as a remedial for conceivable alternative treatment in neurological disorders. Apart from this, progressive findings are important, particularly the refinement of the novel bioactive components and the uncovering of the molecular mechanism responsible for the observed pharmacological impacts.

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