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EXPERIMENTAL EVALUATION OF ANTIDEPRESSANT ACTIVITY OF PLANT LAVANDULA STOECHAS IN SCOPOLAMINE INDUCED ANIMAL MODELS

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ABSTRACT

Context: Anxiety and depression are common disease. Despite some evidence, it is difficult to confirm Lavandula officinalis antidepressant drug. **Objective**: The effects of L. Stoechas extract were studied in scopolamine-induced memory impairment, anxiety and depression-like behaviour. **Materials and Methods:** Male rats were divided into control, scopolamine alone-treated group received scopolamine (0.1mg/kg) intraperitoneally (i.p.), daily and 30 min prior to performing behavioural testing on test day, for 12 continuous days and extract pretreated groups received aerial parts hydro alcoholic extract (i.p.) (200, 400 and 800 mg/kg), 30 min before each scopolamine injection. Memory impairment was assessed by Y-maze task, while, elevated plus maze and forced swimming test were used to measure anxiolytic and antidepressive-like activity. **Results:** Spontaneous alternation percentage in Y maze is increased by scopolamine (15±0.42), whereas lavender (800 mg/kg) enhanced it more (14.5±0.78). Also, lavender pretreatment in LS(800) showed most climbing activity, LS(400) showed highest swimming, LS(200) showed most immobility among all extracts in Forced swimming test (FST). **Discussion and Conclusion:** Lavender extracts improved scopolamine-induced memory impairment giving a clue about therapeutic dose of LS extract should be high i.e. LS(800 mg/kg) for efficacious antidepressant activity.

KEYWORDS: L. Stoechas, antidepressant activity, Y maze, FST.

INTRODUCTION

Depression is a prevalent psychiatric disorder with estimates reaching as high as 21%. For about 2,500 a long time, misery has been depicted as one of the foremost common ailment of mankind, but only as of late it has commanded major public health intrigued[1]. It is manifested by a depressed mood, loss of pleasure in daily activities, sleep disturbances, cognitive difficulties, psychomotor disturbances[2]. Discouragement is a critical worldwide open wellbeing issue due to both its moderately tall lifetime predominance and the noteworthy inability that it causes. Without treatment, misery has the inclination to expect an inveterate course, to repeat, and to be related with expanding inability over time[3]. As of now, diverse classes of antidepressants are accessible, each with particular instrument of activity.

History of depression

For about 2,500 a long time, disposition disarranges have been portrayed as one of the foremost common sicknesses of mankind. What was already known as depression and is presently known as clinical discouragement, major discouragement, or basically discouragement and commonly alluded to as major depressive clutter by many health care experts, encompasses a long history, with comparative conditions being depicted at slightest as distant back as classical times. The term Major depressive clutter was presented by a gather of US clinicians within the mid1970s as portion of recommendations for demonstrative criteria based on designs of indications (called the Inquire about Symptomatic Criteria) and was joined in to the DSM-III in 1980.

Epidemiology of depression

The two most compelling epidemiological thinks about came from the Joined together States: The Epidemiological Catchment Region Consider (ECA) in 1981 and the National Comorbidity Overview (NCS) in 1991. Misery is the foremost frequent psychiatric sickness within the community and in clinical settings. The predominance and rate of unipolar major discouragement is two times more common in ladies than in men.

Diagnosis and Classification of depression

The foremost broadly utilized criteria for diagnosing depressive conditions are found within the American Psychiatric Association's changed fourth version of the Demonstrative and Measurable Manual of Mental Disarranges (DSM-IV-TR), and the World Wellbeing Organization's Worldwide Measurable Classification of Illnesses and Related Wellbeing Issues (ICD-10) which employments the title repetitive depressive clutter.

Agreeing to DSM-IV, misery is classified as takes after: 1. Major depressive clutter (MDD) or unipolar discouragement (MDD is encourage subclassified). 2. Dysthymic clutter 3. Bipolar discouragement 4. Depressive clutter not something else indicated. In this chapter, I have depicted each subtype of misery in more subtle elements.

Pathophysiology of depression

Depression could be a complex marvel. A few factors have been said to be involved within the etiopathophysiology of discouragement. These incorporate natural, hereditary and psychosocial components. A current speculation hypothesizes that misery may be related to impedances in neural versatility. Each pathophysiological component included in sadness was altogether portrayed. The neurobiology of discouragement was for the most part emphazised.

Antidepressants

As of now, distinctive classes of antidepressants are accessible, each with particular instrument of activity. The number of modern classes of antidepressants has developed significantly since the revelation of the "first-generation" antidepressants (tricyclics and monoamine oxidase inhibitors) presented within the 1950„s. Compared with conventional upper drugs, more current medicate classes have progressed tolerability to treatment and a better level of viability.[4]

The classification of current classes of antidepressants is represented in the table below

Table. 1: Classes of antidepressants.

Classes of antidepressants	Chemical names
1. Serotonin selective reuptake inhibitors (SSRIs)	Fluoxetine, sertraline, paroxetine, fluvoxamine, citalopram, escitalopram
2. Serotonin norepinephrine reuptake inhibitors (SNRIs)	Venlafaxine, desvenlafaxine, duloxetine, milnacipran
3. Selective norepinephrine reuptake inhibitors (NRIs)	Reboxetine
4. Alpha 2 antagonists as serotonin and norepinephrine disinbitors (SNDIs)	Mirtazapine
5. Serotonin antagonist/reuptake inhibitors (SARIs)	Trazodone, nefazodone
6. Norepinephrine and dopamine reuptake inhibitors (NRIs)	Bupropion
7. Melatonergic receptors agonist	Agomelatonin
8. Monoamine oxidase inhibitors	Phenelzine, tranylcypromine, isocarboxazid, selegiline transdermal system, selegiline low dose oral, rasagiline, moclobemid
9. Tricyclic and tetracyclic antidepressants	Clomipramine, trimipramine, imipramine, lofrepramine, amitriptyline, nortriptiline, protriptiline, maprotiline, amoxapine, doxepine, desipramine

MATERIALS AND METHODS

In this experimental study, 30 male albino rats (weighing 200 to 250 g) were randomly divided into 5 groups of 6. Animals were housed in cages of 6 at 22 ± 1 ^{o}C in a 12-h light/dark cycle, and had free access to water and food. Each animal was evaluated only once. Animals were transferred laboratory to adapt to the lab environment for 48 hours before testing. All procedures in this study were performed in accordance with the CPCSEA Guide for the Care and Use of Laboratory Animals. The experimental protocol was approved by the Committee on Animal Research; CPCSEA.

In this study, scopolamine (Zydus Cadila), and Lavandula Stoechas hydroalcoholic extract; all in powder form were used. All drugs and extracts were dissolved in normal saline (NS 0.9%) and administered intraperitoneally (i.p.) at a constant volume of 100ml/kg. The negative control group or normal saline group received normal saline (5 ml/kg, i.p). Positive control groups received scopolamine (10ml/kg, i.p) The other three groups were treated with different doses of 200, 400 and 800 mg/kg of Lavandula Stoechas hydroalcoholic extract, respectively.

NATURAL PRODUCT EXTRACTION, ISOLATION AND PURIFICATION

The systemic investigations of plant materials for its photochemical behavior involve
four different stages.

1. The procurement of raw materials and its quality control
2. Extraction, purification and characterization of the constitutes of pharmaceutical interest and in process quality control
3. Investigations of biosynthetic pathway to particular compound
4. Qualitative and quantitative evaluations

Extraction is defined as a technique for separation of active substances from the crude drugs. It involves use of solvents. This requires proper identification and authentication of the crude drug to be extracted. During the extraction, generally powdered plant material being used. Extraction of aromatic acids and phenols requires acidification of the plant materials. Generally, glycosides are soluble in water and alcohol. Water, alcohol and ethyl acetate are good solvents for the Tannins, which are phenolic compounds. Extraction by percolation or by

continuous extraction using soxhlet extractor or may be performed by repeated maceration with agitation.

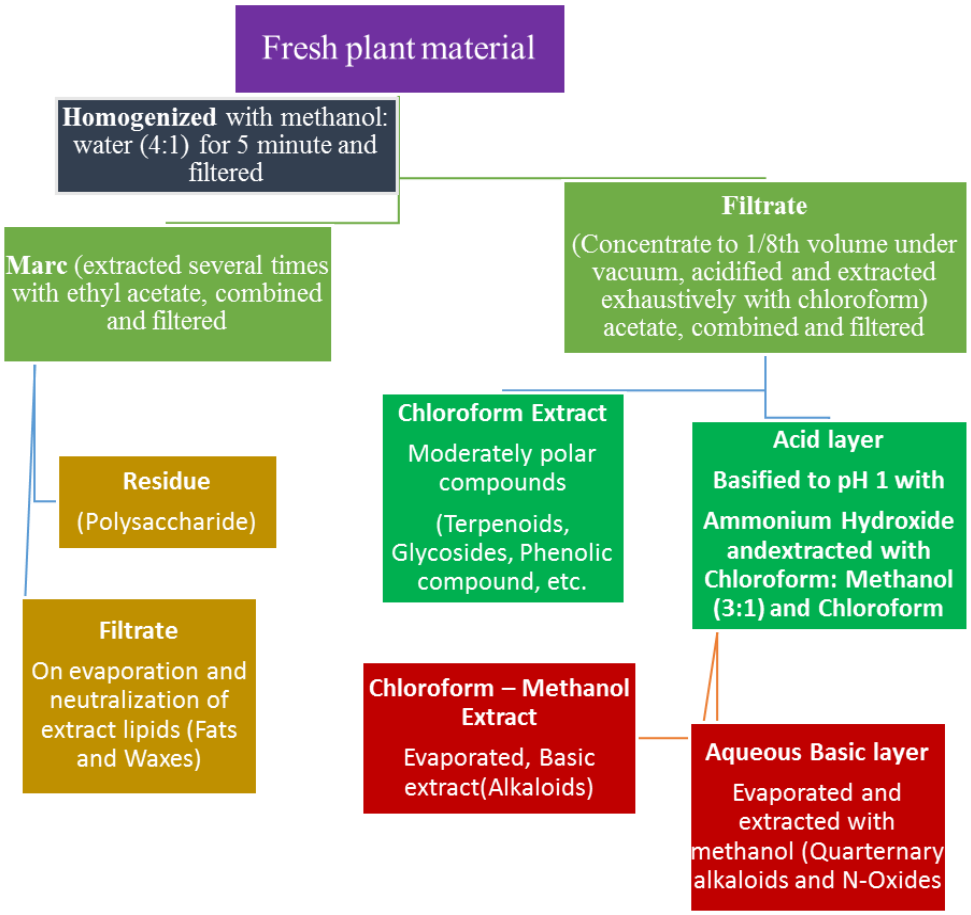
Preliminary photochemical screening

The plants are source of the food materials such as carbohydrates, proteins and lipids that are utilized as food by man, but also other compounds like alkaloids, glycosides, tannins, volatile oil, etc., that bring to bear a physiological and therapeutic effects.

The powdered plant is extracted by soxhlet apparatus using different grade of solvents from n-hexane, n-heptane, DMF, CCl4, ethyl acetate, alcohols, water & Acetic acid in increasing polararity.

The concentrated extract is generally obtained by distillation of the solvent under low pressure followed by evaporation until dryness. The extracts with different solvents can also be prepared by successively maceration (cold extraction) of the powdered drug in order of increase polarity.

The general approach for extraction of different constituents from the freshly plant material may be briefly described in the described in the following chart.



It is quite obvious that the extract of phytoconstituents prepare by maceration or percolation method must be as pure as possible and unless it is reasonably so, the test reaction may not be accurate. Therefore, some purification procedures are usually adopted prior to characterization of individual components. There is always necessitates further purification of plant extracts, which can be performed by various techniques like fractional crystallization, fraction libration, sublimation, distillation, etc.

Figure No. 1: Schematic diagram Soxhlet Apparatus.

ANIMAL MODEL FOR THE EVALUATION OF ANTIDEPRESSANT ACTIVITY

Following consideration should be considered during experiments

1. Water depth and temperature

a. Mice may not touch the bottom with its tail or feet.
b. Depth of approximately 15 to 30 cm.
c. Temperature of water should be kept approximately $25\pm1^{0}C$.
d. The rats should be dry in a warm environment after removal from the H_2O after test.
e. A heating source directed over or underneath the cage has been provide warmth.

2. Water changes

a. The container should be emptied, cleaned and disinfected
b. Fecal material should be removed from the jar after each experiment with a small mesh net.

3. Test procedures

a. T test durations (4-20 minutes)

In the forced swim test (FST), mice were separately placed in cylindrical containers, with dimensions of 8 × 12 × 25 cm, containing water at 25 °C, 30 min after injection of extracts or drugs. Each mouse was judged to be immobile when it ceased struggling and remained floating motionless in the water, making only those movements necessary to keep its head above water. The whole test was 5 minutes, 2 minutes to match the animal to the environment, and next 3 minutes were recorded as immobility time, swimming time and climbing time in seconds by the chronometer. In the forced swim test, immobility time and its reduction were recorded as depression and anti-depression effect, respectively. Swimming is equivalent to active movements of the hands and feet of the animal and the rotation around the cylinder, and climbing is also equivalent to active movements of animal hands on the walls of the cylinder.

Tail suspension test (TST) is also an additional common animal model for estimating depression in animals. In this test, the metal legs with a height of 70 cm were used and a string of 50 cm was longitudinally stretched between two metal legs. Mice tail was closed by a clause and the animal was hung on the tail. In this part also the test began with a rush mouse, 25 min after drug or extract administration. The immobility time was considered when the animal was completely immobile, disabled and had no response.

Table. 2: Tail suspension test (TST).

Treatments	Immobility time (Mins)	Percentage decreased in Immobility entries
Control Negative	36.75±1.35	1.47
Control Positive	37±0.78	1.48
Scopolamine (10 mg/kg)	25±0.42	1.01
LS(200 mg/kg)	28±0.38	1.12
LS(400 mg/kg)	27±0.22	1.08
LS(800 mg/kg)	26±0.78	1.07

Figure 2: Tail suspension test (TST)

The period of this test, the same as the previous method, was 5 minutes, again first 2 minutes to match the animal to the environment and next 3 minutes were recorded as immobility time in seconds by the chronometer. In both tests, all the samples were recorded by a person who did not know which sample belonged to which group. The test was performed 25 min after drug or extract injection. In this study, one-way analysis of variance (one-way ANOVA) and Tukey test were used. The statistical analysis was performed using SPSS, version 16, and in each case the $p<0.05$ was considered as the significance level.

Drugs

Scopolamine hydro bromide was dissolved in sterile isotonic saline (0.9% NaCl) and administered i.p. Dried aerial parts of *Lavandula Stoechas* (500 g) were purchased from the local market and were identified. *Lavandula Stoechas* powder was prepared using a grinder. Then, plant powder was soaked in double-distilled water and methanol 60% (1:4) for 3 d in a dark place at room temperature (25 °C) and filtered. Filtration was repeated three times. All filtrates evaporated to dryness in water bath at 60 °C. The yield of the extract was about 14%. It was stored at −20 °C until test day. Extract was dissolved and diluted in normal saline on the day of experiment.

RESULTS

The results of this study showed that normal saline injection caused no significant change in the immobility, swimming and climbing times compared with the situation before the injection. Therefore, all experimental groups were compared with saline as a negative control. Results showed that the immobility behaviour of all three doses of hydroalcoholic extract of Lavandula Stoechas in the forced swim test (75.25±5.75, 70.15±5.85 and 70.75±2.25 respectively; p0.05). But conversely, scopolamine increased the climbing behaviour (80.44±8.65; p=0.000), but was not observed a significant increase in the swimming behaviour ($p<0.05$).

Forced swimming test (FST)

The possible antidepressant effects of Lavandula Stoechas extract were studied by the FST. On the first day of this test (adaptation day), animals were individually placed into non-transparent plastic cylindrical containers (diameter 30 cm, height 60 cm) containing 25 cm of water at a temperature of 25–26 °C. Rats were left to swim for 15 min before being removed, dried and returned to their cages. Testing was repeated after 24 h for 6 min (test day). This procedure was performed on the 11th and the 12th day 30 min after administration of the last drug. Test parameters on the test day were immobility times (time spent floating with the minimal movements to keep the head above the water). Effects of Lavandula Stoechas oil inhalation on improving scopolamine-induced spatial memory impairment in laboratory rats.

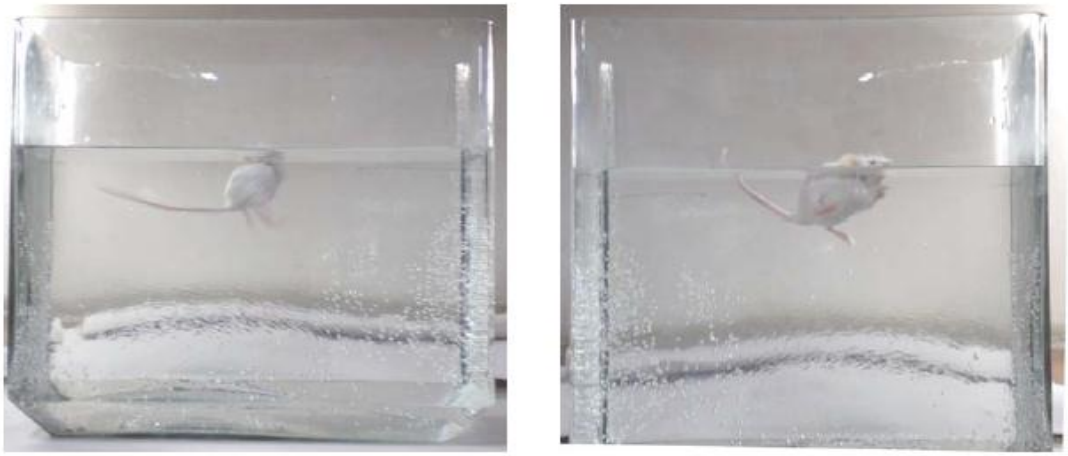


Figure 3: Forced swimming test (FST).

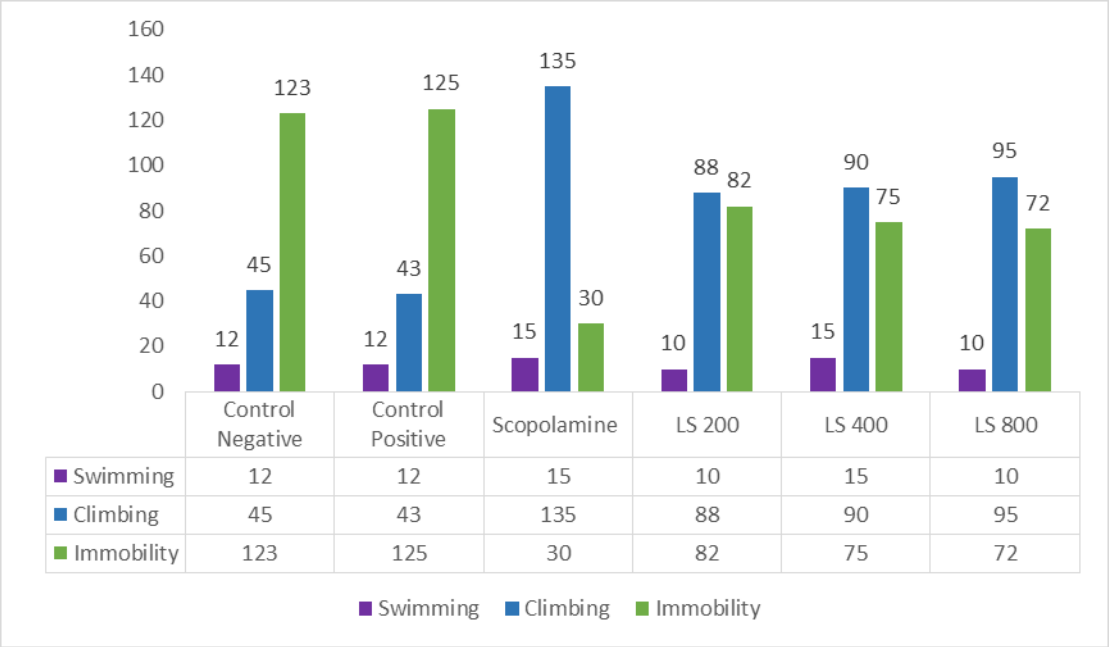


Figure 4: The effect of different doses of hydroalcoholic extract of Lavandula Stoechas (LS; 200, 400, and 800 mg/kg; i.p), scopolamine (10 ml/kg; i.p) on immobility, swimming and climbing in the forced swimming test in mice. The data are shown as Mean±SEM; ***significant at p

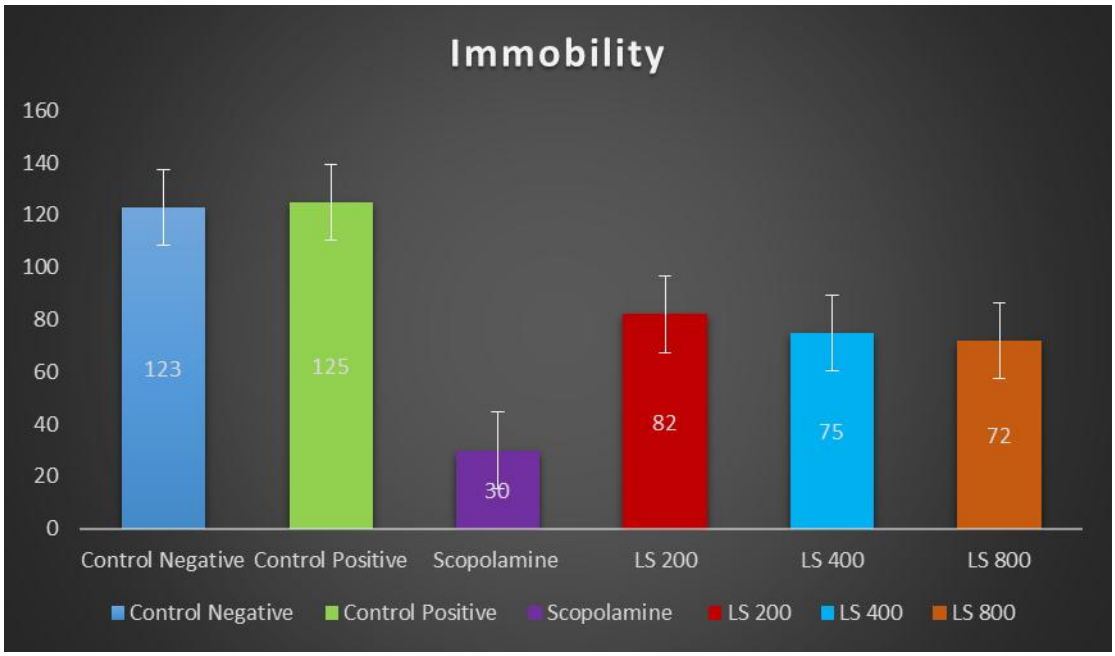


Figure 5: The effect of different doses of hydroalcoholic extract of Lavandula Stoechas (LS; 200, 400, and 800 mg/kg; i.p), scopolamine (10 ml/kg; i.p) on immobility time in the tail-supension test in male mice. The data are shown as Mean±SEM; ***significant at p

Behavioural testing apparatus

Y-maze task

Scopolamine-induced memory impairment was assessed by Y-maze task on the ninth day. Short-term memory was studied by spontaneous alternation behaviour in the Y-maze task. The Y maze used in the present study consisted of three arms (35 cm long, 25 cm high and 10 cm wide) and an equilateral triangular central area. Sixty minutes after Lavandula Stoechas extract administration and 30 min after administration of scopolamine, rats were placed at the end of one arm and allowed to move freely through the maze for 4 min. The time limit in Y-maze test was 4 min, and every session was stopped after 4 min. An arm entry was counted when the hind paws of the rat were completely within the arm. Spontaneous alternation behaviour was defined as entry into all three arms on consecutive choices. The number of maximum spontaneous alternation behaviours was then the total number of arms entered minus 2 and percent spontaneous alternation was calculated as (actual

alternations/maximum alternations) × 100. Effects of Lavandula Stoechas oil inhalation on improving scopolamine-induced spatial memory impairment in laboratory rats. Spontaneous alternation behaviour is considered to reflect spatial working memory, which is a form of short-term memory.

Figure 6: Y-maze task.

Table 3: Y-maze task.

Treatments	Complete arm entries	Percentage decreased in Open arm entries
Control Negative	12.75±1.35	1.6
Control Positive	13±0.78	1.73
Scopolamine (10 mg/kg)	15±0.42	2.056
LS(200 mg/kg)	2.8±0.38	0.186
LS(400 mg/kg)	2.7±0.22	0.180
LS(800 mg/kg)	14.5±0.78	0.966

Elevated plus-maze (EPM) task

On the 10th day, behaviour in the EPM is also utilized to measure exploration, anxiety and motor behaviour. The EPM consists of four arms, 49 cm long and 10 cm wide, elevated 50 cm above the ground. Two arms were enclosed by walls 30 cm high and the other two arms have no walls. On the 10th day of experiments, 30 min after the last drug administration, each rat was placed at the juncture of the open and closed arms and the amount of time spent on the open arms was recorded during a 5 min test. After each assay, the maze was carefully cleaned with wet tissue. Time spent on the open arms is an index of anxiolytic effects of. Effects of Lavandula Stoechas oil inhalation on improving scopolamine-induced spatial memory impairment in laboratory rats.

Table 4: Elevated plus-maze (EPM) task.

Treatments	Open arm entries	Percentage decreased in Open arm entries
Control Negative	13.83±1.24	2.305
Control Positive	14±0.73	2.33
Scopolamine (10 mg/kg)	13±0.81	2.16
LS(200 mg/kg)	2.5±0.5	0.416
LS(400 mg/kg)	2.5±0.34	0.418
LS(800 mg/kg)	12.5±0.99	2.08

Figure 7: Elevated plus-maze (EPM) task.

Lavandula Stoechas Chemical Analysis

Essential oil was obtained by hydro-distillation of dried aerial parts of plant. Then, the chemical composition of essential oil was determined. On this basis, its main ingredients were l-camphor (66%), eucalyptol or 1,8-cineol (4.4%), borneol (2.9%), fenchone (1.03%), α-linalool (0.93%), *cis*-α-terpineol (0.23%), myrtenal (1.24%), bornyl acetate (0.10%), caryophyllene oxide (1.66%), α-eudesmol (2.57%), 1*R*-α-pinene (0.50%) and camphene (0.69%).

However, the main active ingredients of Lavandula Stoechas extract are seems to be non-volatile constituents, because a lot of volatile constituents of lavender, escape during the preparation of extract. Therefore, extract analysis also was performed.

Extract analysis

Phytochemical screening tests

Preliminary phytochemical screening

Screening tests for flavonoids, alkaloids, tannins, saponins, cardiac glycosides and sterols were done based on the standard methods as follows.

Table 5: Parameters of Lavandula Stoechas.

LAVANDULA STOECHAS	
Parameters	**Values in (% w/w)**
1. Moisture content	86.16±3.260
2. Loss on drying	5.77±0.228
3. Ash value	
a. Total ash	5.89±0.115
b. Acid-insoluble ash	0.74±0.040
c. Water-soluble ash	4.62±0.053
d. Sulphated ash	1.21±0.090
4. Crude fibre contents	8.07±0.133

Test for flavonoids

Flavonoids of the extracts are often detected by Cyanidin test. One gram of extract was dissolved in methanol (50%), HCl (37%) powder of magnesium and amyl alcohol (50%). Flavonoids appeared as orange to red zone. Extract of the Chamomile flowers was used as a standard of flavonoids (positive control). Effects of aqueous, methanolic and chloroform extracts of rhizome and aerial parts of lavandula stoechas on scopolamine -induced jumping in morphine dependent mice.

Test for alkaloid

For the detection of alkaloids, three drops of Dragendroff reagents were added to the fraction that is separated by using HCl, NaCl, methanol and chloroform from 1 g of extract. Alkaloids appeared as brown, blue or whitish zone. A thin-layer chromatogram (TLC) spot test with Dragendroff, Wagner and Mayer's reagents was performed for checking the results. Effects of aqueous, methanolic and chloroform extracts of rhizome and aerial parts of *lavandula stoechas.* on scopolamine -induced jumping in morphine dependent mice.

Test for tannin

Plant extract (about 1.0 g) was stirred with sterile-distilled water (10 ml) and filtered (using Whatman number 1 filter paper). A blue colouration resulting from the addition of two drops of 10% $FeCl_3$ reagent to the filtrate indicated the presence of tannins (pseudo tannins. Preliminary phytochemical screening and antibacterial properties of crudestem bark extracts and fractions.

Also, according to the standard protocol, tannins were detected by adding NaCl (10%) and gelatin (1%) to the dissolved fraction of 1 g of extract in 20 ml of boiled water. The amount of precipitation showed the presence of tannins. As a standard positive control, the extract of *Quercus infectoria* fruits was used for tannins evaluation. Effects of aqueous, methanolic and chloroform extracts of rhizome and aerial parts of *lavandula stoechas*. on scopolamine -induced jumping in morphine dependent mice.

Test for saponin
For saponins determination, the height of the foam produced after shaking the extract (1 g) in distilled water (10 ml) is one of the standard ways to determine the amount of saponins. Liquiritiae radix root extract was used as a standard for saponins. Effects of aqueous, methanolic and chloroform extracts of rhizome and aerial parts of *lavandula stoechas* on scopolamine -induced jumping in morphine dependent mice.

Test for cardiac glycosides
The extract (about 0.5 g) was dissolved in glacial acetic acid (2 mL) containing 1 drop of 1% $FeCl_3$. This was underlaid with concentrated H_2SO_4. A brown ring at the interface indicated the presence of a deoxy sugar, a characteristic of cardiac glycosides. A violet ring may form just above the brown ring and gradually spreads through this layer. Preliminary phytochemical screening and antibacterial properties of crudestem bark extracts and fractions of *lavandula stoechas.*

Test for sterols
Both Salkowski test and Liebermann–Burchard test were performed.

Salkowski test
2 ml of chloroform and 2 ml of concentrated H_2SO_4 was added to 2 ml of plant extract, and shaken well. The chloroform layer appeared red and the acid layer greenish yellow fluorescent. This confirms the presence of sterols.

Liebermann–Burchard test
2 ml of methanolic plant extract was mixed with chloroform. About 1–2 ml acetic anhydride and two drops of concentrated H_2SO_4 from the side of the test tube was added in the mixture. First red, then blue and finally green colour indicates the presence of sterols. Preliminary phytochemical screening of methanolic extract of *lavandula stoechas.*

Preliminary Phytochemical screening showed that Sterols, Flavonoids, pseudo tannins ($FeCl_3$ test), Saponins and Cardiac glycosides are present in the extract, while Tannins and Alkaloids are absent.

Determination of total phenolic content
Total phenols were determined using Folin–Ciocalteu reagent as described. Antioxidant activity and total phenolics in selected products with slight modifications. The extract (200 µL) was mixed with 1.5 ml of Folin–Ciocalteu reagent (previously diluted 10 times with distilled water) and allowed to stand at room temperature for 5 min. 1.5 ml sodium bicarbonate solution (60 g/L) was added to the mixture and after incubation for 90 min at room temperature, the absorbance level was measured at 750 nm using a UV–Visible spectrophotometer. Total phenolics were quantified by calibration curve obtained from measuring the absorbance of the known concentrations of Gallic acid standard solutions (25–150 µg/mL in 80% methanol). The results were calculated as Gallic acid equivalent (GAE) per 250 µg dry extract. Antioxidant activity and total phenolics in selected products. The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals. Comparative antioxidant activity and total flavonoid content of lavandula stoechas cultivars.

Determination of total flavonoids content
Total flavonoids content was measured by the aluminium chloride colorimetric assay. An aliquot (1 mL) of extracts or standard solution of catechin (50, 100, 150, 200, 250 and 300 mg/L) was added to 10 ml volumetric flask containing 4 mL of double-distilled water. Then 0.3 mL 5% $NaNO_2$ was added to the flask and, after 5 min, 0.3 ml $AlCl_3$ (10%) was also added. At the sixth minute, 2 ml NaOH (1 M) was added and the total volume was made up to 10 ml with double-distilled water. The solution was mixed completely and the absorbance level was measured versus prepared reagent blank at 510 nm. Total flavonoids's content was expressed as catechin equivalent (CE) per 500 µg dry extract. The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals. Comparative antioxidant activity and total flavonoid content of lavandula stoechas cultivars. Total phenol content of the extract was 40.66 ± 2.5 µg GAE/250 µg extract, while total flavonoids content of the extract was 100.9 ± 8.7 µg CE/500 µg extract, whereas GAE is Gallic acid equivalent, and CE is Catechin equivalent.

CONCLUSION
According to the results of this study, LS has considerable antidepressant-like effect in animal models of depression. However, concomitant use of serotonin and GABA antagonists along with the LS extract, and isolation of each of its components and evaluation of them on depression is recommended in order to determine the exact mechanism of LS antidepression effects. the immobility behaviour of all three doses of hydroalcoholic extract of Lavandula Stoechas in the forced swim test (75.25±5.75, 70.15±5.85 and 70.75±2.25 respectively; p0.05). But conversely, scopolamine increased the climbing behaviour (80.44±8.65; p=0.000), but was not observed a significant increase in the swimming behaviour ($p<0.05$).

In the Y-maze task the Complete arm entries of Scopolamine treated rats was highest and also having maximum in Percentage decreased of Open arm entries. LS(400 mg/kg) showed the lowest Complete arm entries and in Percentage decreased of Open arm entries.

In the Elevated plus-maze (EPM) task the Complete arm entries of Control Positive treated rats were highest and also having maximum in Percentage decreased of Open arm entries. LS (400 mg/kg) showed the lowest Complete arm entries and in Percentage decreased of Open arm entries.

The main active ingredients of Lavandula Stoechas extract are seems to be non-volatile constituents, because a lot of volatile constituents of lavender, escape during the preparation of extract. Essential oil was obtained by hydro-distillation of dried aerial parts of plant. Then, the chemical composition of essential oil was determined. On this basis, its main ingredients were l-camphor (66%), eucalyptol or 1,8-cineol (4.4%), borneol (2.9%), fenchone (1.03%), α-linalool (0.93%), cis-α-terpineol (0.23%), myrtenal (1.24%), bornyl acetate (0.10%), caryophyllene oxide (1.66%), α-eudesmol (2.57%), 1R-α- pinene (0.50%) and camphene (0.69%).

In our study we conclude that the antidepressant activity of plant lavandula stoechas in scopolamine induced experimental animal models was performed and found out that LS(800) showed most climbing activity, LS(400) showed highest swimming, LS(200) showed most immobility among all extracts in Forced swimming test (FST). "Thus giving a clue about therapeutic dose of LS extract should be high i.e. LS(800 mg/kg) for efficacious antidepressant activity".

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