

PHARMACOLOGICAL SCREENING OF GERANIUM OIL FOR ITS ANTIDEPRESSANT POTENTIAL

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ABSTRACT

Objective: The aim of the present study was to investigate the effect of geranium oil on depression-related behavior of mice in the forced swimming test (FST), tail suspension test (TST), and open field test (OFT).

Materials and Methods: The animals were divided into three groups containing six animals in each group. Group I served as a control group and treated with dist. Water (10 ml/kg, p.o), Group II served as standard and treated with imipramine (15 mg/kg, p.o) and Group III served as test group and treated with geranium oil (200 mg/kg, inhalation method) for 14 days. On the 14 days after the treatment of drug and standard total duration of immobility was recorded for 6 minutes using TST, FST and the total number of crossings, time spent in center, time spent in periphery recorded for 5 minutes in OFT.

Results: Geranium oil significantly reduced the duration of immobility as compared to control group in FST and TST model. Total number of crossings, time spent in the center significantly increased, whereas time spent in periphery significantly decreased as compared to control group in OFT.

Conclusion: These results suggested that geranium oil has the significant antidepressant potential.

Keywords: Depression, Geranium oil, Tail suspension test, Forced swim test, Open field test.

INTRODUCTION

Depression is an important global public-health issue and is associated with substantial disability [1]. It is characterized by a disturbance of mood associated with alteration in behavior, energy, appetite, sleep, and weight [2] and generally associated with severe functional impairment. The World Health Organization revealed that the depression is the fourth leading cause of disability worldwide, exceeded by lower respiratory infections, perinatal conditions, and HIV/AIDS [3]. Available antidepressants are often associated with their anticipated adverse effects like dry mouth, inability in driving skills, constipation, and sexual dysfunction, therefore, these factors led to an interest in using alternative remedies. Several indigenous drugs are being evaluated because of their easy availability, lack of adverse events and cost effectiveness, majority of patients are reluctant to take these treatments. Geranium oil is a well-known essential oil which can be used as alternative treatment for depression and it may be due to its major constituents geraniol, citronellol, geranyl acetate, citronellyl formate, menthone, they exhibited a wide range of stimulant activity [4]. Despite the widespread uses of the plant, no scientific work is reported in the literature regarding the effect of geranium oil against depression, the present study is thus planned to evaluate antidepressant effects of geranium oil in rodents.

MATERIALS AND METHODS

Plant material

The geranium oil was procured and authenticated by BMV Fragrances Pvt. Ltd Gr. Noida, India, during the month of October. (Reference no. SS/31st August 2013 BMW Fragrances Pvt. Ltd.).

Drug and chemicals

Imipramine (Zenith Healthcare Limited, Mehsana, Gujarat), geranium oil (BMV Fragrances Pvt. Ltd Gr. Noida, India). All drugs and chemicals were of analytical grades.

Animals

Swiss albino mice (weighing between 18 and 25 g) obtained from the animal house of Babu Banarasi Das Northern India Institute of

Technology (BBDNIIT), Lucknow were used in the study. They were maintained at a temperature of 22±5°C, relative humidity 55±5°C with free access to food and water ad libitum, under a 12:12 light/dark cycle (light on at 8:00 h). All manipulations were carried out only once between 9:00 and 15:00 hrs with each animal used.

The experimental protocol was approved by the Institutional Animal Ethics Committee as per the direction of the Committee for the Purpose of Control and Supervision of Experiments on Animals (approval no BBDNIIT/IAEC/030/2014). The animals were acclimatized for a period of 7 days before the study. All efforts were made to reduce the number of animals used and treated humanely to minimize their pain and discomfort.

Groupings and treatment

Animals were divided randomly into three groups of six mice in each group. Group I (control group) received vehicle dist. Water (10 ml/kg, p.o). Group II (standard group) received imipramine (15 mg/kg, p.o). Group III (test group) received geranium oil (200 mg/kg, inhalation method) for 14 days.

Method of inhalation

Inhalation apparatus consists of a glass chamber (30 cm×15 cm). On the floor of the chamber, up to 15 cm a cotton bed was made where the animals were placed individually, the oil embedded cotton was placed in the apparatus and animal was exposed to aroma for 7 minutes. Cotton with oil was renovated to maintain the oil concentration into the apparatus. For the ventilation, the top of the chamber was opened for 5-10 seconds at regular interval [5].

Pharmacological screening

Tail suspension test (TST)

Animals were suspended upside down on a metal rod at a height 50 cm from the ground with the help of an adhesive tape placed approximately 1 cm from the tip of the tail. Initially, the animals try to escape by making vigorous movement but when unable to escape became immobile. The

total duration of immobility was noted for 6 minutes [6]. Animal was considered to be immobile when it didn't show any body movement [7] and hung passively and completely motionless [8].

Forced swim test (FST)

Animals were forced to swim in a plastic cylinder measuring 30 cm ×30 cm containing water at depth of 20 cm [9]. At this height of water, animals were not able to support themselves by touching the bottom or the side walls of the chamber with their hind-paws or tail. Water in the chamber was changed after subjecting each animal to FST because "used water" has been shown to alter the behavior. Each animal showed vigorous movement during initial 2 minute period of the test. The total duration of immobility was noted for 6 minutes. Mice were considered to be immobile when they ceased struggling and remained floating motionless in the water, making only those movements necessary to keep their head above water [10].

Open field test (OFT)

This test utilizes behavioral changes in rodents exposed to novel environments and is used to confirm that the observed antidepressant. Mice were individually placed in a wooden box (40×60×50) with the floor divided into 12 squares. The number of crossing in the squares with the four paws [11] and time spent in periphery squares and time spent in center squares were registered during a period of 5 minutes [12].

Statistical analysis

Experimental results were expressed as means±standard error of the mean. The data were analyzed by an analysis of variance, one-way ANOVA followed by Tukey post-test.

RESULTS

Geranium oil (200 mg/kg, via inhalation) and imipramine (15 mg/kg, p.o) administered to mice for 14 successive days significantly decreased the duration of immobility as compared to control group (Table 1 and Figs. 1 and 2).

Geranium oil (200 mg/kg, inhalation method) and imipramine (15 mg/kg, p.o) administered to mice for 14 successive days significantly decreased the duration of immobility as compared to control group (Table 2).

Geranium oil (200 mg/kg, inhalation method) and imipramine (15 mg/kg, p.o) administered to mice for 14 successive days significantly increased the total number of crossing and time spent in center as compared to control group, whereas it significantly decreased the time spent in periphery as compared to control (Table 3 and Figs. 3-5).

DISCUSSION

Depression is the most common affective disorders, defined as disorders of mood rather than disturbances of thought or cognition it may range

from a very mild condition, bordering on normality, to severe psychotic depression accompanied by hallucinations and delusions [13]. There is an increasing interest in the study of the antidepressant effect of herbs, since treatment of depression with conventional antidepressants (monoamine oxidase inhibitors, tricyclics, selective serotonin reuptake inhibitors, selective noradrenaline reuptake inhibitors) provides a complete remission just for 50% of the individuals [14]. The current therapeutic goal in the treatment of major depression is to improve the quality-of-life by normalizing mood and reversal of functional and social disabilities associated with depression. The two most widely used animal models for antidepressant screening are the FST and TST. These tests are quite sensitive and relatively specific to all major classes of antidepressants. TST is based on the principle that suspending mice upside down leads to a characteristic behavior of immobility after initial momentary struggle. This behavior reflects a state of despair which can be reduced by several agents which are therapeutically effective in human depression [6]. FST was designed by Porsolt as a primary screening test for antidepressants. It is still one of the best models for this procedure. It has a great sensitivity with all the antidepressant classes, and all the mechanisms of action of treatments could be determined [15]. In this model, mice are forced to swim in restricted space from which they cannot escape. This induces a state of behavioral

Table 1: Effect of geranium oil on the duration of immobility in TST

S. No.	Groups	Treatment	Duration of immobility (seconds)
1.	Control	Distilled water (10 ml/kg, p.o)	193.50±2.23
2.	Standard	Imipramine (15 mg/kg, p.o)	123.83±2.35***
3.	Test	Geranium oil (200 mg/kg, inhalation)	133.50±7.48***

Results expressed as mean±SEM (n=6), significant at ***P<0.001, as compared with the control group by one-way ANOVA followed by Tukey test, SEM: Standard error of the mean, TST: Tail suspension test, SEM: Standard error of the mean

Table 2: Effect of geranium oil on the duration of immobility in FST

S.No.	Groups	Treatment	Duration of immobility (seconds)
1.	Control	Distilled water (10 ml/kg, p.o)	271.50±5.35
2.	Standard	Imipramine (15 mg/kg, p.o)	133.67±12.53***
3.	Test	Geranium oil (200 mg/kg, inhalation)	60.17±8.78***

Results expressed as mean±SEM (n=6), significant at ***p<0.001 as compared with the control group by one-way ANOVA followed by Tukey test. FST: Forced swim test, SEM: Standard error of the mean

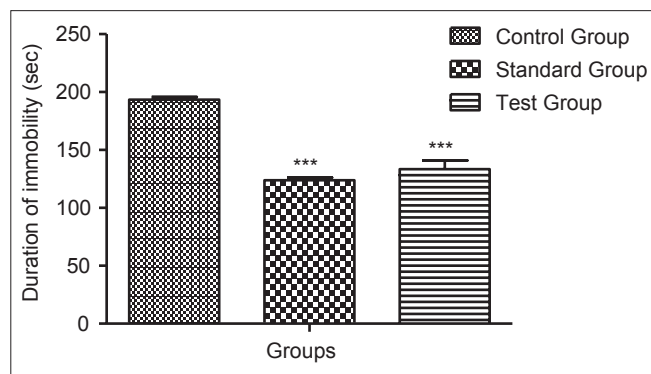


Fig. 1: Effect of geranium oil on duration of immobility in the tail suspension test

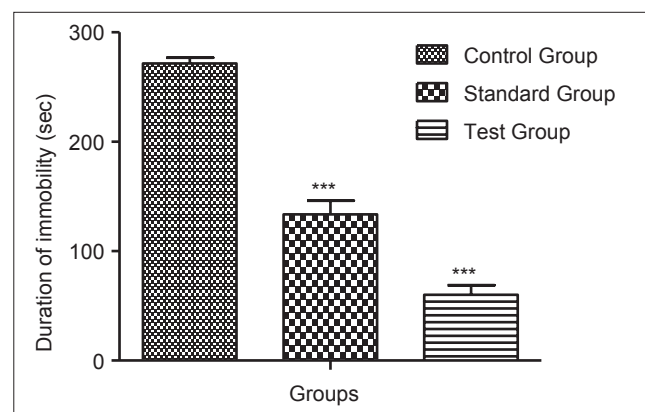


Fig. 2: Effect of geranium oil on duration of immobility in the forced swim test

Table 3: Effect of geranium oil on the total number of crossings, time spent in center and time spent in periphery in OFT

S. No.	Groups	Treatment	Total number of crossings	Time spent in centre (seconds)	Time spent in periphery (seconds)
1.	Control	Distilled water (10 ml/kg, p.o)	83.00±5.84	1.67±0.17	88.67±11.39
2.	Standard	Imipramine (15 mg/kg, p.o)	92.67±3.86	1.83±0.25	58.50±5.19
3.	Test	Geranium oil (200 mg/kg, inhalation)	102.17±4.77*	2.83±0.82	40.00±12.17*

Values are mean±SEM, n=6, significant at *p<0.05 as compared with the control group by one-way ANOVA followed by Tukey test, OFT: Open field test, SEM: Standard error of the mean

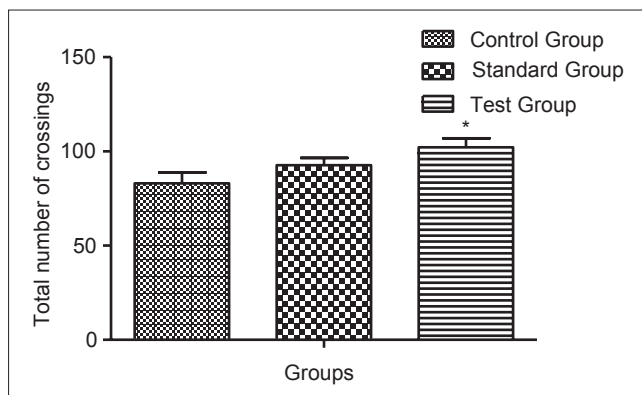


Fig. 3: Effect of geranium oil in the total number of crossings in open field test

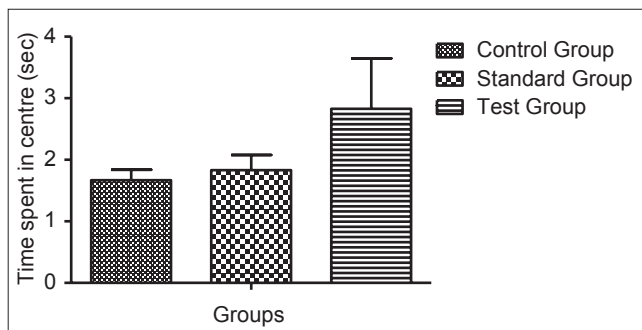


Fig. 4: Effect of geranium oil in time spent in the center in open field test

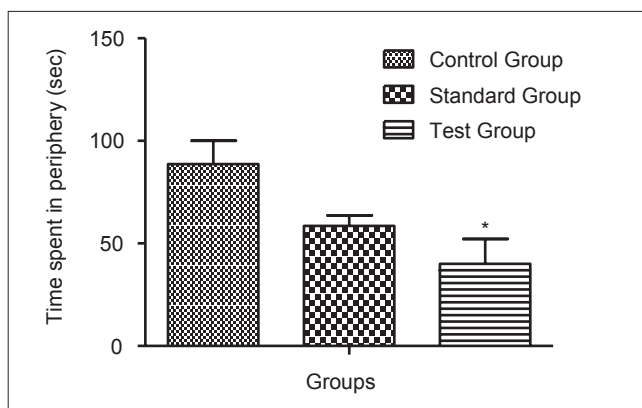


Fig. 5: Effect of geranium oil in time spent in periphery in open field test

despair in animals, which is claimed to reproduce a condition similar to human depression [8]. The OFT is thought to provide indices of motor activity, emotional reactivity, and exploration, peripheral locomotion and leaning relate to motor activity in a novel environment, rearing is

assumed to be under the influence of several processes, including motor abilities. These three factors are labeled “motor reactivity axis” [12]. This model used to study the exploratory and locomotor activity. Stress factors account for the decreases in mobility and functional responses against novel environment [1]. Geranium oil is a well-known essential oil which can be used as alternative treatment for depression and it may be due to its major constituents geraniol, citronellol, geranyl acetate, citronellyl formate, menthone, they exhibited a wide range of stimulant activity [4]. In the present study, it is observed that geranium oil (200 mg/kg, inhalation method) and imipramine (15 mg/kg, p.o) for 14 days significantly decreases the duration of immobility in the TST and the FST as compared with their control groups. In the OFT inhalation of geranium oil and imipramine increases the total number of crossings and time spent in the center as compared to control group whereas time spent in periphery decreases as compared to control group.

CONCLUSION

These findings suggested that geranium oil has antidepressant property. Further studies are necessary to elucidate the biochemical changes which are responsible for the antidepressant-like effects.

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