

ijcrr

Vol 03 issue 03

Category: Research

Received on:29/12/10

Revised on:30 /01/11

Accepted on:10/02/11

BEHAVIORAL AND BIOCHEMICAL STUDIES OF SEEDS OF *CORIANDRUM SATIVUM* IN VARIOUS STRESS MODELS OF DEPRESSION

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ABSTRACT

Depression is one of the most common and costly brain diseases; there is a need to develop more effective medications to treat this devastating disorder. Among Indian population there is an increasing demand for herbal drugs due to their low side effects. Hence the plants are the good candidates for evaluation of antidepressant activity. The aim of present work was to investigate the antidepressant activity of seeds of *Coriandrum Sativum* using various behavioral models of depression. For this purpose Behavior tests like Forced swimming test and Tail suspension test were used. And also Biochemical estimation of Monoamine oxidase-B enzyme activity was carried out. Both extract of *Coriandrum Sativum* shows significant antidepressant effect and also inhibit the Monoamine oxidase –B enzyme. Taking together, the finding in the current study shows that extracts of seeds of *Coriandrum Sativum* displays a behavioral profile consistent with an antidepressant like action. Further research should be aimed to isolating the active principle responsible for antidepressant activity and exploring the mechanism by which it produce a antidepressant effect.

Keywords: Depression, Forced swimming test, Tail suspension test, Monoamine oxidase-B, antidepressant activity.

INTRODUCTION

Depression is one of the most prevalent psychopathologies in the world. Conventional antidepressant treatment has many limitations such as some are slow to take effect, side effect profile limiting compliance and there are also a large number of treatment resistant patients.¹ Such a profile has necessitated new therapeutic strategies in offering faster onset of action and augmenting the therapeutic actions of currently existing antidepressants and thus getting a greater

efficacy in a larger proportion of patients. *Coriandrum Sativum* L. has been recommended for relief of insomnia in Iranian traditional medicine and also brain tonic in Ayurveda². On the other hand various plants have been recommended brain tonics viz. *Withania somnifera* (Ashwagandha)³. *Asparagus racemosus* (Shatavari)⁴. *Bacopa monniera* (Brahmi) were evaluated for their antidepressant effect⁵. However, no pharmacological activity of *Coriandrum Sativum* have yet evaluated for its antidepressant effect. As the coriander seeds were evaluated for anxiolytic effect⁶. And the present work was undertaken to determine the antidepressant effect of aqueous extracts

and fatty oil of coriander seeds. The two models are used for present study i. e. forced swimming test and Tail suspension test. Both models reflect a state of despair which can reduce by several agents which are therapeutically effective in human depression⁷. The immobility displayed by rodents when subjected to an unavoidable and inescapable stress has been hypothesized to reflect behavioral despair which in turn may reflect depressive disorders in humans. Clinically effective antidepressants reduce the immobility that mice display after active and unsuccessful attempts to escape when suspended by the tail.⁷ It was suggested that mice or rats forced to swim in a restricted space from which they cannot escape are induced to a characteristic behavior of immobility. Measurement of immobility time was carried out by observing the motor activity of mice, which were placed in a pool of water.

MATERIAL AND METHOD

Seeds of *Coriandrum Sativum* were collected from local market in Sangli. The seeds of *Coriandrum Sativum* identified by the Department of Botany at Deccan Education Society's Willingdon College, Sangli.

Preparation of aqueous extract

Air dried seeds was homogenized to a fine powder. Hundred grams of powdered coriander was infused in 500 ml cold distilled water for 24 h, brought to the boil, then removed from the heat source and allowed to infuse for 15 min. The extract was filtered, then concentrated over the water bath and brought to dryness under vacuum⁶. The yield of the extract was 6.5%.

Preparation of Fixed oil extract

The seeds of the *Coriandrum Sativum* were ground in mixer. The 100gm of powdered

material was macerated with 500ml of Diethyl ether for 2 hrs. The solvent was evaporated.^{8,9}. The yield of the extract was 1.02% w/v. The toxicity study was carried out according the test procedure described in OECD Guideline (425) to estimate acute oral toxicity of drug.¹⁰ from the result obtained by toxicity study, it was concluded that the drug extracts are safe and non toxic for use.

Screening methods

Male Swiss mice weighing 25gm were used. The animals were kept under normal light-dark conditions and at a constant temperature. The animals had free access to standard laboratory food and water. The mice were divided three groups, six animals in each group. One group served as control and received distilled water. And other two received 200 mg/kg & 400 mg/kg doses of Aqueous extract of *Coriandrum Sativum* for Forced swimming test and 300mg/kg & 600mg/kg for Tail suspension test. Aqueous extract of *Coriandrum Sativum* was suspended in distilled water, immediately prior to use and given as orally dosage. For the Diethyl ether extract, 0.4 ml/kg, 0.6 ml/kg given as orally for Forced swimming test and 0.6ml/kg & 0.8 ml/kg for Tail suspension test.

Forced swimming test

After 14 day administration of drug, Measurement of immobility time was carried out by observation the motoric activity of the mice, which were placed in a pool of water. A glass cylinder, 25 cm in diameter, height 23 cm was filled with water to a height of 12 cm. The temperature of water was 23+₋ 1⁰ c on the day of testing, after 30 min of dosing animal were subjected to test. Measurement was carried out for six min. The first two minute the animal was allowed to adjust to

the new condition after this two minute, the immobility time that alternated with conditions of enhanced motor activity was measured. Immobility time was measured with a stopwatch for the next four minute¹¹.

Tail suspension test

The tail suspension test was the second method for assessing the antidepressant effect of the extract. Thirty minutes after the single drug or vehicle injection, mice were subjected to the test.

A cord of about 50 cm in length was stretched between two mental tripods at a height of ca 70 cm, to which the mice were attached by the tail with sticky tape. After the initial period of vigorous motor activity, the mice become still and the immobility time was measured with a stopwatch, for a total duration of 4 minutes¹²

Statistics

For quantitative data statistical analysis was initially performed by using a one way analysis of variance (ANOVA).

Biochemical estimation

Preparation of brain Monoamine oxidase¹³

Rats (n=12) were decapitated and allowed to bleed. The brains were removed as quickly as possible, placed on a filter paper and their weights determined. All subsequent procedures were performed at 0–4 °C. The brains were rinsed thoroughly in cold saline (0.9% NaCl), then homogenized in 4 volume (w/v) of 0.25 M sucrose, 0.1 M sodium phosphate buffer (pH 7.4) in a Teflon glass homogenizer. The homogenates were centrifuged at 600×g for 10 min. The supernatant fraction was divided into 3-ml portions in small screw-cap vials and kept frozen for later assaying of MAO.

Kinetic assay of MAO-B¹³

All assays were carried out in triplicate at 30 ± 0.1 °C in 0.1 M sodium phosphate buffer, pH 7.4. Results are mean values \pm standard deviation of the mean. MAO-B activity was measured using benzylamine as substrate as follows: Mitochondrial protein (100 μ l, 600 μ g protein) in 0.1 M sodium phosphate buffer, pH 7.4 (total assay volume, 3 ml) was incubated in cuvette (pathlength 10 mm) in Ultramicroscopy and 1000 nm wavelength in UV/visible Spectrophotometer. The reaction was started by addition of benzylamine (25 μ l of 1 mM solution in water) and the progress of the reaction (formation of benzaldehyde) was monitored at 250 nm. Initial velocities as $\Delta A/\text{min}$ were measured from the time scanning of the reactions at 250 nm, ϵ ($\text{M}^{-1}\text{cm}^{-1}$) 12500. The maximum velocity was expressed as μ mol/mg protein per min¹³.

RESULT AND DISCUSSION

Forced swimming test and Tail suspension test are currently most widely used models of animal depression¹¹. And has been validated for use with rat and mice. The indices of depression in these models were “Immobility Time” Shorter immobility time, stronger antidepressant effect.

In present study, two doses 200 mg/kg, 400 mg/kg of Aqueous extract and 2 ml/kg, 4 ml/kg of Diethyl ether extract have been administered for 14 successive days in FST model (Table no. 1). While 300 mg/kg and 600 mg/kg of aqueous extract and 6 ml/kg, 8 ml/kg of Diethyl ether extract of seeds of *Coriandrum Sativum* have been administered for 14 successive days in TST (Table no.2). The efficacies of the extracts were found to be comparable to fluoxetine (SSRI) and Imipramine (Tricyclic antidepressant). While comparing the results obtained by above two models,

which have been used different stress situations to induce states of terror and despair, it can be observed that the Diethyl ether extract i. e. fatty oil shows more potent effect on reduction of immobility time than aqueous extract (Table no. 3).

According to the M. Emamghoreishi et al, the aqueous extract of coriander seed caused a dose dependent general reduction of the spontaneous activity in pentobarbital-induced sleeping time, decreased general locomotor activity and neuromuscular coordination⁶. Present study also supports the above findings. But fatty oil of seeds of *coriandrum sativum* did not show significant change in locomotor activity of mice as compared to control. So it did not produce any motor effect. It is confirmed the assumption that the antidepressant effect of fatty oil of seeds of *Coriandrum Sativum* is specific.

Depression is related to alterations of the monoamine oxidase. MAO-A and MAO-B are biochemical markers of depression. The conversion of Benzyl amine to benzaldehyde has been shown to occur readily in tissue homogenates and to be dependent upon monoamine oxidase activity. The reaction can be followed conveniently in a spectrophotometer and has been developed in to simple and rapid method for the assay of monoamine oxidase¹⁴. The results were expressed in % of control. In the present study, the Aqueous extract of seeds of *Coriandrum Sativum* showed marked decreases MAO-B activity with time (figure no. 1 & 2). Hence aqueous extract of seeds of *Coriandrum Sativum* showed antidepressant like activity probably by inhibiting MAO enzyme, thus increased monoamine levels of brain.

CONCLUSION

Taking together, the finding in the current study shows that extracts of seeds of

Coriandrum Sativum displays a behavioral profile consistent with an antidepressant like action.

1. In the psychopharmacological evaluation, the extracts of seeds of *Coriandrum Sativum* tested in forced swimming test & Tail suspension test, shows significantly antidepressant like action.
2. On the other hand, it was observed that Diethyl ether extract of seeds of *Coriandrum Sativum* showed more significant antidepressant effect than that of Aqueous extract when statistically significant difference compared to the control group of animal.
3. MAO-B is one of the biochemical marker of depression, antidepressant drug achieve their therapeutic effect through reversing alteration of this markers. Aqueous extract of seeds of *Coriandrum Sativum* showed antidepressant activity probably by inhibiting MAO enzyme.
4. By reviewing all the observations of FST & TST, it was indicated that both the extract of *Coriandrum Sativum* seeds have antidepressant like effect similar to that of Imipramine & Fluoxetine, therefore, it will be used in clinical practice.

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Table 1: Effect of aqueous extract and Diethyl ether extract of seeds of *Coriandrum Sativum* on immobility period in FST

Sr.no.	Drug treatment for 14 days / oral	No.of animals	Dose	Immobility time(s) (mean \pm SEM)
1	Control(distilled water)	6	10 ml	192 \pm 11.9
2	Fluoxetine	6	20 mg/kg	157 \pm 17.55
3	Imipramine	6	15 mg/kg	129.66 \pm 11.9
4	AECS	6	200 mg/kg	102 \pm 20.49
5	AECS	6	400 mg/kg	89 \pm 10.59
6	DEECS	6	2 ml/kg	83 \pm 13.8
7	DEECS	6	4 ml/kg	70.66 \pm 11.8

AECS = Aqueous extract of seeds of *Coriandrum Sativum*

DEECS = Diethyl ether extract of seeds of *Coriandrum Sativum*

Statistical analysis of data was carried out by one way ANOVA followed by Dunnett t- test.

Values are expressed as mean \pm SEM, P<0.001 is considered as criterion of significance.

P<0.01 as compared to control

Table 2: Effect of aqueous extract and Diethyl ether extract of seeds of *Coriandrum Sativum* on immobility period in TST

Sr.no.	Drug treatment for 14 days / oral	No.of animals	Dose	Immobility time(s) (mean \pm SEM)
1	Control(distilled water)	6	10 ml	188 \pm 6.75
2	Fluoxetine	6	20 mg/kg	109.16 \pm 25.48
3	Imipramine	6	15 mg/kg	150.16 \pm 6.49
4	AECS	6	300 mg/kg	102.66 \pm 31.86
5	AECS	6	600 mg/kg	86.5 \pm 8.26
6	DEECS	6	6ml/kg	115.5 \pm 21.14
7	DEECS	6	8ml/kg	93.83 \pm 14.49

AECS = Aqueous extract of seeds of *Coriandrum Sativum*

DEECS = Diethyl ether extract of seeds of *Coriandrum Sativum*

Statistical analysis of data was carried out by one way ANOVA followed by Dunnett's- test.

Values are expressed as mean \pm SEM, P<0.001 is considered as criterion of significance.

P<0.01 as compared to control

Table 3: Comparison between effect of aqueous extract and diethyl ether extract of seeds of *Coriandrum Sativum* on TST and FST

Treatment	Dose	FST		Dose	TST	
		Immobility time(s)	% change		Immobility time(s)	% change
Control	-	192 ± 11.9	-	Control	188 ± 6.75	-
Aq. Extract	200 mg/kg	102.33 ± 20.49	46	300 mg/kg	102.66 ± 31.66	45
Aq. Extract	400 mg/kg	89.16 ± 10.59	54.5	600 mg/kg	86.5 ± 8.2	53
Diethyl ether extract	2 ml/kg	83 ± 13.8	56.7	6 ml/kg	115.5 ± 21.14	72.5
Diethyl ether extract	4 ml.kg	70.66 ± 11.8	63.19	8 ml/kg	93.83 ± 14.49	94.17

FST: forced swimming test, TST: Tail suspension Test

Figure 1: Spectrophotometric Determination of MAO-B activity of aqueous extract of Seeds of *Coriandrum Sativum* in vitro

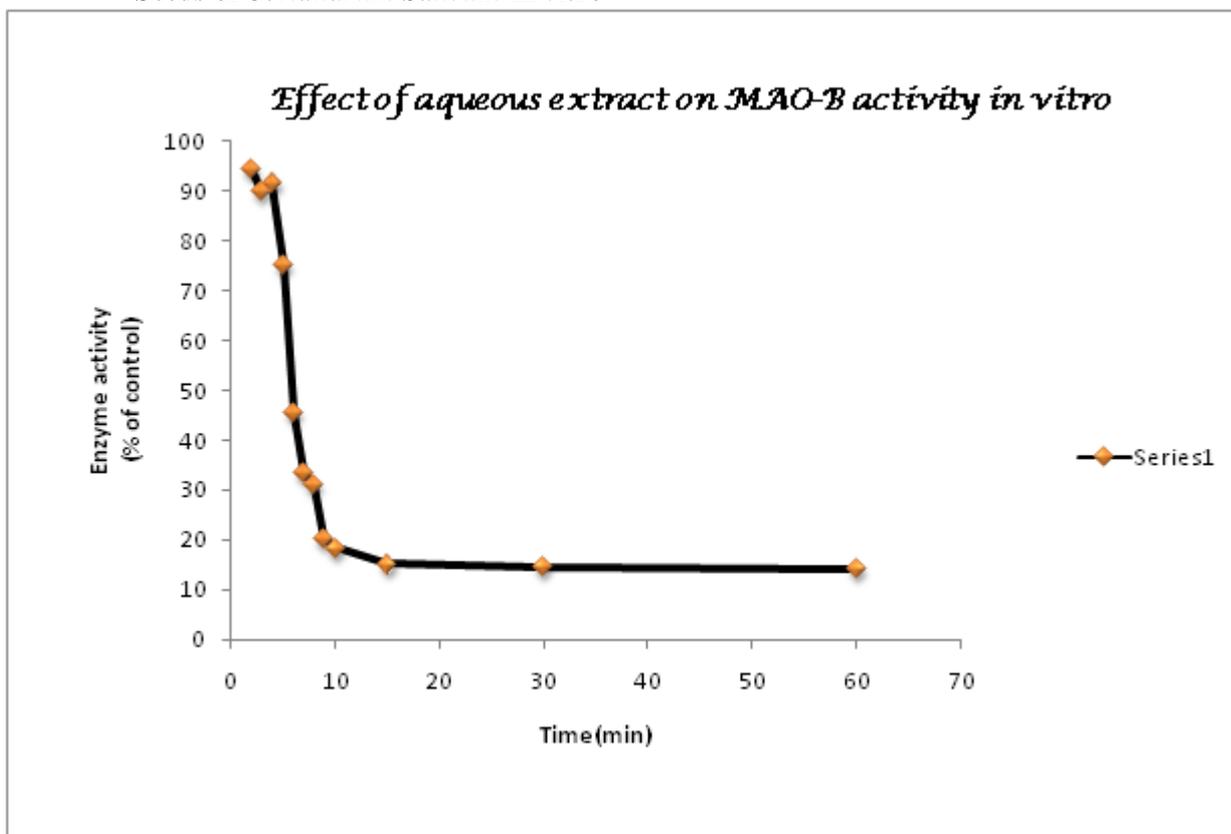
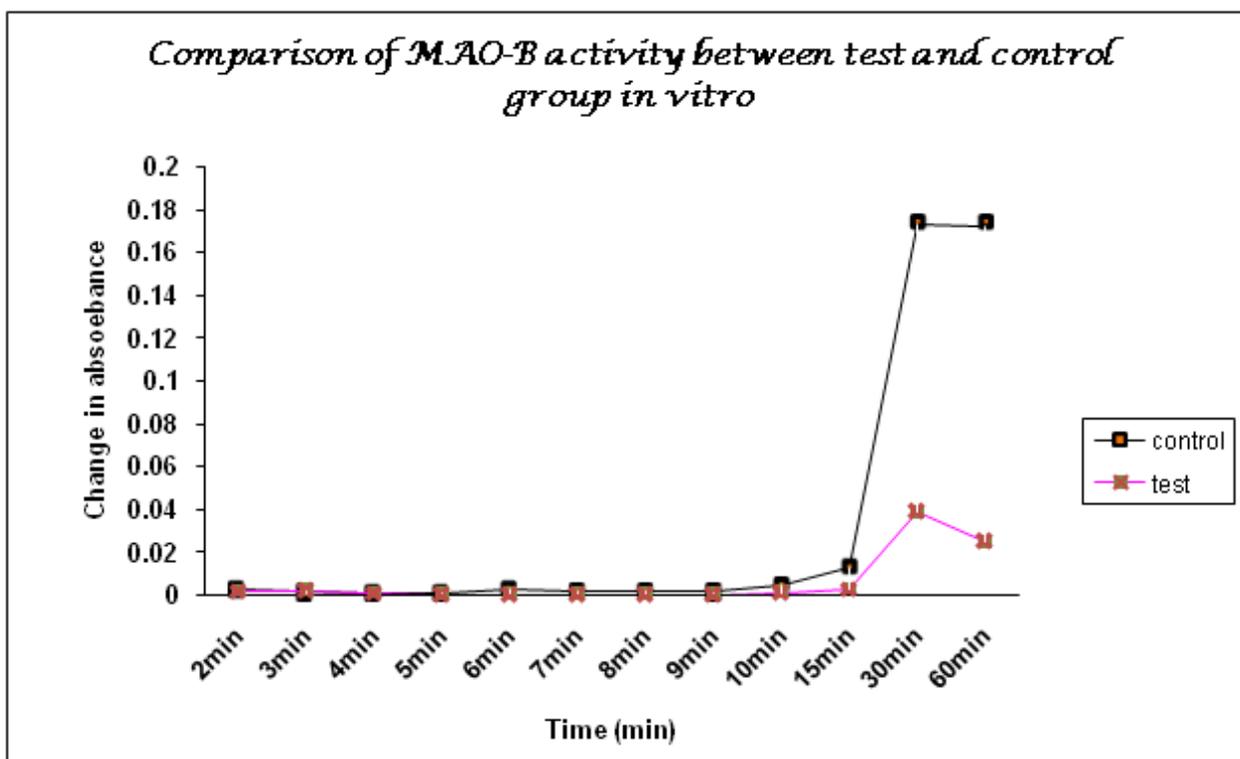


Figure 1. Shows Activity of Monoamine Oxidase enzyme was decreases with time

Figure 2: Comparison of MAO-B activity between test and control group in vitro



Test = Aq. extract of seeds of *Coriandrum Sativum*.

Figure 2 Shows increase in absorbance in control group due to increase in enzyme activity with time.