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Coriandrum sativum: evaluation of its anxiolytic effect in the elevated plus-maze

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Abstract

The clinical applications of benzodiazepines as anxiolytics are limited by their unwanted side effects. Therefore, the development of new pharmacological agents is well justified. Among medicinal plants, *Coriandrum sativum* L. has been recommended for relief of anxiety and insomnia in Iranian folk medicine. Nevertheless, no pharmacological studies have thus far evaluated its effects on central nervous system. Therefore, the aim of this study was to examine if the aqueous extract of *Coriandrum sativum* seed has anxiolytic effect in mice. Additionally, its effect on spontaneous activity and neuromuscular coordination were evaluated. The anxiolytic effect of aqueous extract (10, 25, 50, 100 mg/kg, i.p.) was examined in male albino mice using elevated plus-maze as an animal model of anxiety. The effects of the extract on spontaneous activity and neuromuscular coordination were assessed using Animex Activity Meter and rotarod, respectively. In the elevated plus-maze, aqueous extract at 100 mg/kg showed an anxiolytic effect by increasing the time spent on open arms and the percentage of open arm entries, compared to control group. Aqueous extract at 50, 100 and 500 mg/kg significantly reduced spontaneous activity and neuromuscular coordination, compared to control group. These results suggest that the aqueous extract of *Coriandrum sativum* seed has anxiolytic effect and may have potential sedative and muscle relaxant effects.

Keywords: *Coriandrum sativum*; Anxiolytic; Elevated plus-maze; Spontaneous activity; Neuromuscular coordination

1. Introduction

Anxiety disorders in a modern society have a relatively high prevalence and command considerable financial resources. Currently, the most widely prescribed medications for anxiety disorders are the benzodiazepines. However, the clinical uses of benzodiazepines are limited by their side effects such as psychomotor impairment, potentiation of other central depressant drugs and dependence liability. Therefore, the development of new medications possessing anxiolytic effect without the complications of benzodiazepines would be of great importance in the treatment of anxiety-related disorders. Medicinal plants are a good source to find new remedies for these disorders.

In Iranian traditional medicine, *Coriandrum sativum* L. (Umbelliferae) has been indicated for a number of medical problems such as dyspeptic complaints, loss of appetite, convulsion, insomnia and anxiety (Zargari, 1991; Mir Heidar, 1992). For the medical purposes, coriander seed is empirically used in different dosage forms, including powdered seeds or dry extract (2–5 g/day), tea (4–8 g/100 ml; up to 30 g), tincture (1:8 g/ml) (10–20 drops), decoction or infusion (Zargari, 1991; Mir Heidar, 1992). The juice of fresh leaves (30 g) and tea, or powdered seeds of coriander have been recommended for the relief of anxiety and insomnia (Mir Heidar, 1992), taken usually as a single dose before sleeping. Similar uses of coriander seed (i.e. for relief of nervousness and insomnia) have been indicated in other folk medicines as well (Duke, 1983, 2002). However, no pharmacological or medical studies have evaluated the effects of *Coriandrum sativum* L. (coriander) on central nervous system. Therefore, the present study was undertaken to see if the

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aqueous extract of coriander seed has any anxiolytic effect in mice. Additionally, the possible effects of the coriander extract on spontaneous activity and motor coordination were evaluated.

2. Materials and methods

2.1. Animals

Male albino mice weighting 25–35 g were purchased from the Animals House, Shiraz University of Medical Sciences. Mice were housed in cages of 5 at 22 ± 1 °C in a 12-h light/dark cycle. Tap water and food pellets were available as libitum. Groups of 6–11 mice were randomly assigned to different treatment groups and tested in a counterbalancing order. Animals were naive to experiment conditions. All experiments were carried out in a quiet room under dim red light between 9:00 a.m. and 2:00 p.m.

2.2. Plant material

Dried seeds of coriander were purchased from a commercial source in Shiraz, Iran. The identity of the seeds was confirmed by the Department of Pharmacognosy, Tehran University of Medical Sciences, Pharmacy School, Tehran, Iran. A voucher specimen (C-100) was kept in our laboratory for future reference.

2.3. Preparation of aqueous extract

Dried coriander seeds were 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 vacuum. The yield of the extract was 7.9% (w/w).

2.4. Drugs

Diazepam hydrochloride (10 mg/2 ml; Darou Pakhsh, Tehran, Iran) was used as a reference drug. It was diluted to 0.3 and 3 mg/10 ml with saline before use. Different concentrations of the coriander extract were prepared by serial dilution from a stock solution of 50mg/ml of the extract in saline. All solutions were prepared freshly on test days and administered intraperitoneally (i.p.) in a volume of 0.1ml/10 g body weight of mice.

2.5. Elevated plus-maze model of anxiety

Anxiolytic activity was measured using the elevated plus-maze test (Lister, 1987). The maze consisted of two open (30 cm × 5 cm × 0.2 cm) and two closed (30 cm × 5 cm × 15 cm) arms, extending from a central platform (5 cm × 5 cm) and elevated to a height of 45 cm above the floor. The entire maze was made of clear Plexiglas. Mice were individually placed on the center of the maze facing an open arm, and the number of entries and the time spent in closed and open arms were recorded during a 5-min observation period. Arm entries were defined as entry of all four paws into an arm. The percentage of open arm entries (100 × open/total entries) was calculated for each animal. The experimental animals were intraperitoneally treated with diazepam (0.3 mg/kg, n = 10) or the aqueous extract (10, 25, 50 or 100 mg/kg, n = 6–10), 30 min and 45 min, respectively, before evaluation in the maze. The coriander extract at doses higher than 100 mg/kg caused a marked decrease in motor activity that interfered with an accurate evaluation of anxiolytic effect. Therefore, higher doses of the extract were not included in the plus-maze test.

2.6. Spontaneous activity

Activity of individual mice was recorded using Animex Activity Meter (AB FARAD model, Sweden). Activity counts were cumulated 20 min after administration of saline (i.p., n = 11), diazepam (3 mg/kg, i.p.; n = 7) or the coriander extract (10, 50, 100 or 500 mg/kg, i.p.; n = 7) at 5-min intervals for 30 min.

2.7. Neuromuscular coordination – Rotarod

The effect of the coriander extract on coordinated motor movements was assessed using the rotarod test. A day before the test, mice were trained to stay on the rotating wheel (3 cm in diameter, 20 rpm) for more than 1 min. On the test day, mice were tested on the rotarod (model 7600, UGO Basile, Italy) before and 50 min after the administration of saline, diazepam or the aqueous extract of coriander seed (i.e. immediately after the activity test). The number of seconds each mouse remained on the rotating wheel was recorded for a maximum of 300 s.

2.8. Statistics

Data from evaluation of the coriander extract in the elevated plus-maze test were statistically analyzed using one-way ANOVA. Independent t-test was used for the comparison of means between saline-treated group and diazepam in the elevated plus-maze. Spontaneous activities were evaluated using an analysis of variance for repeated measures (between-subject factor: treatment; within-subject factor: postdosing time). Data from the rotarod were evaluated using univariate analysis of variance with time spent on the rotarod before injection as covariate. Post hoc comparisons between individual groups were performed using Dunnett t test. Statistical analyses were performed using SPSS 10.0 software. $P < 0.05$ was considered as a significant level.