Geraniol Reduced Anxiety-like Effects in Rats Exposed to Single Electric Shock

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ABSTRACT

Plant derived monoterpenoids have been historically used in treating neurological ailments, geraniol a plant based monoterpenoid have shown considerable potential against neuropsychiatric disorders. Thus, the aim of current study is to evaluate the effects of geraniol (a plant based monoterpenoid) in animal model of anxiety. Rats were divided in 5 groups (n=8) comprising of control, disease model, low dose treatment, high dose treatment, and positive control (diazepam) group. Geraniol and diazepam were administered for 5 days through intra-peritoneal injection while control group received saline. At the end of dosing period, a single stressor consisting of electric shock (1.0 mA, 1 s) was given to all groups except controls. Behavioral analysis was carried out using open field test (OFT), elevated plus maze (EPM), and social interaction test (SIT) which showed that the acute stressor produced anxiogenic effects in untreated rats while geraniol and diazepam treated rats showed reduced anxiety-like effects.

Keywords: Anxiety disorder, Neuropsychiatric disorders, Monoterpenoid, Geraniol, Electric shock.

INTRODUCTION

Neuropsychiatric disorders such as anxiety, depression, and bipolar disorder inflict a high disease burden globally and are difficult to treat because of their complex pathophysiology. These disorders severely affect quality of life and exert heavy burden in the healthcare system which may become fatal in some cases. Despite of their widespread nature, these disorders are not understood effectively due to the intricate structure of the organ involved and culturally associated taboos with mental illnesses [1]. Anxiety is defined as body's response to a perceived/actual threat or fear. This response is productive for a short period of time allowing body to adapt and perform accordingly in a stressful situation, however, when it becomes chronic and irrepressible then it is contemplated as a disorder due to hinderance in every-day life [2]. Treatment paradigm mostly aim to manage symptoms of these disorders and improve quality of life. Plant-derived compounds provide important drugs for the treatment and management of neurological symptoms particularly through essential oils. Since essential oils are minor metabolic products produced as a response of plants immune system, therefore, these components also have a long history of being used as traditional medicine [3]. Geraniol, a plant-derived monoterpenoid has shown some efficacy against depression and stress-induced deficits. It also showed efficacy against depression in mice induced by chronic unpredictable mild stress (CUMS) through the NF-κB pathway [4]. Moreover, it has shown anxiolytic effects in mice subjected to chronic restraint stress (CRS) [5]. However, the effects of geraniol against anxiety induced by a single stressor have not been studied previously. Therefore, the aim of current study is to evaluate the effects of geraniol in animal model of anxiety.

METHODOLOGY

Male Wistar rats (average weight 200 g) housed in groups of 2 or 3 with food and water *ad libitum* under 12:12 hour light-dark cycle. Rats were divided into 5 groups (n=8) including control, disease model, treatment low dose (10 mg/kg), treatment high dose (30 mg/kg) and diazepam treated group (3.5 mg/kg). Drugs were administered through i.p. injection for 5 days after habituation while control group received normal saline. Doses were chosen based on a pilot-dose response study carried out in our lab in which geraniol showed optimum beneficial effects and minimum side effects at the doses of 10 and 30 mg/kg. All rats except controls were subjected to electric foot shock of 1.0 mA for 1 s on 5^{th} day of dosing. After resting period of 1-3 h, behavioral tests including EPM, OFT, and SIT were performed. After the completion of behavioral analyses, animals were decapitated to collect the brain samples which were then kept at -20°C until further analysis.

RESULTS

Behavioral analysis showed induction of anxiety-like symptoms in un-treated rats following the exposure of electric foot shock as seen through various parameters of OFT such as freezing, grooming, time spent in periphery, and defecation all of which were increased in disease model rats, while in SIT no. of active interactions decreased in these rats. However, rats treated with diazepam and geraniol particularly at high dose showed less anxiety-like effects. Malondialdehyde (MDA) analysis also showed decreased MDA levels in treated groups as compared to untreated group indicating decreased lipid peroxidation in treated rats. Additionally, the levels of reduced glutathione (GSH) decreased in untreated group as compared to treated and control groups. Thus, the present study demonstrates neuroprotective effects of geraniol against anxiety disorders, nonetheless, further studies are required to determine the full potential and mechanism of action of geraniol against neurological diseases.

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