Journal of Ethnopharmacology 134 (2011) 294–297

Contents lists available at ScienceDirect

Journal of Ethnopharmacology

journal homepage: www.elsevier.com/locate/jethpharm

Gastric antisecretory and antiulcer activities of *Cedrus deodara* (Roxb.) Loud. in Wistar rats

Avadhesh Kumar [a], Vandana Singh [b], Amrendra Kumar Chaudhary [a,*]

[a] School of Pharmaceutical Sciences, Shobhit University, NH-58, Modipuram, Meerut 250110, UP, India
[b] Translam Institute of Pharmaceutical Education and Research, Meerut 250001, India

ARTICLE INFO

Article history:
Received 31 August 2010
Received in revised form
10 November 2010
Accepted 10 December 2010
Available online 21 December 2010

Keywords:
Cedrus deodara
Antiulcer
Pylorus
Ethanol
Rabeprazole

ABSTRACT

Ethnopharmacological relevance: Cedrus deodara (Roxb.) Loud. is used in Ayurvedic medicine to treat peptic ulcer.
Aim of the study: To evaluate the gastric antisecretory and antiulcer activity of *Cedrus deodara*.
Materials and methods: The volatile oil extracted by steam distillation of *Cedrus deodara* wood was examined for its gastric antisecretory and antiulcer effect in the pylorus-ligated rat model and ethanol induced gastric lesions in rats.
Results: The volatile oil showed significant antisecretory activity as evidenced by decreased gastric fluid volume, total acidity, free acidity and increase in the pH of the gastric fluid in pylorus-ligated rats. Our studies also revealed that pretreatment with *Cedrus deodara* significantly reduced the number of ulcer, ulcer score and ulcer index in pylorus-ligated and ethanol treated rats. The antiulcer activity of *Cedrus deodara* is further supported by histopathological study which showed protection of mucosal layer from ulceration and inflammation.
Conclusion: The present findings conclude that volatile oil of *Cedrus deodara* wood has potent antisecretory and antiulcer effects and justify the traditional usage of this herb to treat peptic ulcers.

1. Introduction

The plants *Cedrus deodara* (Roxb.) Loud. belonging to the family Pinaceae is a species of cedar, native to the Western Himalayas in Eastern Afghanistan, Northern Pakistan, North-Central India, South Western Tibet and Western Nepal, occurring at 1500–3200 m altitude (Shah, 2006). The chemical constituents obtained from different parts of the plant include wikstromal, matairesinol, dibenzylbutyrolactol (Rao et al., 2003; Singh et al., 2007), bergapten, isopimpinellin, lignans 1,4 diaryl butane, benzofuranoid neo lignan, isohemacholone, sesquiterpenes LIII: deodarone, atlantone (Shankaranarayan et al., 1977), deodarin, deodardione, limonenecarboxylic acid, α-himacholone, β-himacholone, cedrin (6-methyldihydromyricetin), taxifolin, cedeodarin (6-methyltaxifolin), dihydromyricetin and cedrinoside (Agrawal et al., 1980). The wood oil of *Cedrus deodara* has been used since ancient days in Ayurvedic medical practice for the treatment of ulcer (Hussain et al., 2006; Shah, 2006). However, there is not enough scientific data to support the claims made in the ancient literature. Recent *in vivo* and *in vitro* studies have indicated its anti-inflammatory, analgesic (Shinde et al., 1999a), anti-hyperglycemic, anti-spasmodic, antibacterial, insecticidal (Singh and Agarwal, 1987), anti-apoptotic, immunomodulatory (Shinde et al., 1999b), anti-cancer (Singh et al., 2007) and molluscidal (Gupta et al., 1988) activity.

Although a number of anti-ulcer drugs such as antacid, H_2 receptor antagonist, proton pump inhibitor, cytoprotectives, and prostaglandin analogues are available for treatment of ulcer, all these drugs have side effects and limitations.

The need for safer and effective antisecretory and anti-ulcer drug and the lack of enough scientific data to support the claims made in ancient literature prompted the present study.

2. Materials and methods

2.1. Collection and authentication of plant material

The wood of *Cedrus deodara*, obtained from a commercial supplier and authenticated by Dr. Anjula Pandey, Principal Scientist, National Botanical Plant Genetic Research Institute (NBPGR), New Delhi, India. A voucher specimen has been deposited at the NBPGR Herbarium (NHCP/NBPGR/2009-32 dated November 19, 2009).

2.2. Extraction of volatile oil

The plant material cut into small pieces, was subjected to hydro distillation using Clevenger apparatus. The oil was separated from aqueous layer, dried over anhydrous sodium sulphate and stored

* Corresponding author. Tel.: +91 9450883086; fax: +91 121 2575724.
E-mail address: amrendrapharma@gmail.com (A.K. Chaudhary).

0378-8741/$ – see front matter © 2010 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.jep.2010.12.019

in an amber colored glass bottle in cool place (Shinde et al., 1999a; Handa et al., 2008).

2.3. Animals

Wistar rats of either sex (160–240 g) and Swiss albino mice (25–30 g) were obtained from Indian Veterinary Research Institute, Bareilly, UP, India. The animals were housed in polypropylene cage under standard conditions (25 ± 2 °C, 12 h light and dark cycle) with free access to standard pellet feed (Ashirwad Industries, Mohali, Punjab) and water *ad libitum*. All the experimental procedures and protocols involving animals were reviewed by the Institutional Animal Ethical Committee (Registration Number: 1279/ac/09/CPCSEA) and were in accordance with the guidelines of CPCSEA.

2.4. Phytochemical testing

The volatile oil was subjected to preliminary phytochemical screening for the presence of terpenoid, phenolics, alcohol, aldehyde and ketone. The terpenoid was evaluated by using Salkowski (Edeoga et al., 2005) and Liebermann–Burchard's test (Parekh and Chanda, 2007). The total phenolic content in *Cedrus deodara* was determined by using bromine water and Liebermann test. Alcohol content of *Cedrus deodara* was determined by Lucas test. The aldehyde was evaluated by Benedict's solution, Fehling's solution and Tollens test. The presence of ketone in *Cedrus deodara* was determined by using 2,4-dinitrophenylhydrazine test.

2.5. Acute toxicity study

The *Cedrus deodara* was administered orally in dose of 50, 100, 200, 300, 400 and 500 mg/kg to groups of mice ($n = 6$) and percentage mortality was noted 24 h later.

2.6. Gastric secretion in pylorus-ligated rats

Gastric secretion content, pH, total acidity, free acidity, number of ulcer, ulcer score and ulcer index were measured according to the method of Shay et al. (1945). One hour after oral administration of volatile oil of *Cedrus deodara* (50 and 100 mg/kg) or Rabeprazole (20 mg/kg) or vehicle (10 ml/kg mixture of 3% (w/v) acacia and tragacanth in distilled water), the animals were subjected to pylorus ligation under thiopental sodium anaesthesia. The animals were sacrificed with an overdose of thiopental sodium after 4 h of pyloric ligation. The abdomen was opened, cardiac end of the stomach was dissected out and the contents were drained into a glass tube. The volume of the gastric juice was measured and centrifuged at 2000 rpm for 10 min. From the supernatant, aliquots (1 ml of each) were taken for the determination of pH, total and free acidity. Total acidity and free acidity were determined using titrimetry (Trease and Evans, 1992). The inner surface of free stomach was examined for gastric lesions. The number of ulcers was counted. Ulcer scoring was done according to the method by Vogel and Vogel (1997) as given below.

The scores were: 0 = no ulcer, 1 = superficial ulcer, 2 = deep ulcer, 3 = perforation.

Ulcer index was measured by using the following formula (Vogel and Vogel, 1997)

$$\mathrm{UI} = U_N + U_S + U_P \times 10^{-1}$$

UI is the ulcer index; U_N is the average number of ulcers per animal; U_S is the average number of severity score; and U_P is the percentage of animals with ulcers.

Percentage inhibition of ulceration was calculated as follows:

$$\%\ \text{Inhibition of ulceration} = \frac{(\text{Ulcer index control} - \text{Ulcer index test}) \times 100}{\text{Ulcer index control}}$$

2.7. Gastric lesions induced by ethanol

Lesions were induced according to the method of Vogel and Vogel (1997). Rats, fasted for 24 h but with free access to water were used. One hour after the treatments (*Cedrus deodara*: 100 mg/kg or Rabeprazole: 20 mg/kg or vehicle: 10 ml/kg mixture of 3% (w/v) acacia and tragacanth in distilled water), 90% ethanol (5 ml/kg) was administered orally. The animals were sacrificed under ether anaesthesia, 1 h after ethanol treatment. The stomach of each animal was excised and opened along the greater curvature. The numbers of ulcer, ulcer score, ulcer index and % inhibition of ulcer were determined.

2.8. Histopathological evaluation

The stomach samples from the pylorus ligated and ethanol treated groups were preserved in 10% buffered formalin and processed for routine paraffin block preparation. Using a rotary microtome, sections of thickness of about 5 μm were cut and stained with haematoxylin and eosin. These were examined under the microscope for histopathological changes such as degeneration, hemorrhage, edematous appearance, erosion and necrosis.

2.9. Statistical analysis

The results were expressed as mean ± standard deviation of mean (SD). Analysis of variance (ANOVA) was applied to compare and analyse the data followed by Dunnett's *t*-test.

3. Results

3.1. Yield of plant extract

The 1185 g wood powder of *Cedrus deodara* was taken for extraction of volatile oil by water distillation method using Clevenger apparatus. Total 5.80 ml volatile oil was obtained. The yield of volatile oil of *Cedrus deodara* was found to be 0.47% (v/w).

3.2. Phytochemical testing of Cedrus deodara

Phytochemical testing showed that the volatile oil of *Cedrus deodara* contains terpenoids, phenols, alcohol and ketone.

3.3. Acute toxicity

The mice treated with oral administration of 50 and 100 mg/kg of *Cedrus deodara* were normal. The animals which received 200, 300, 400 mg/kg showed signs of depression. The animals treated with 500 mg/kg of *Cedrus deodara* showed 50% mortality. In the study, volatile oil of *Cedrus deodara* was administered in 50 and 100 mg/kg dosage, which was determined as the most effective dosage in a previous report (Shinde et al., 1999b).

3.4. Gastric secretion in pylorus-ligated rats

Gastric secretion measurements of pylorus-ligated rats showed that *Cedrus deodara* significantly decreased the gastric content, pH, total and free acidity at doses of 50 mg/kg and 100 mg/kg. Rabeprazole (20 mg/kg), the reference compound used also showed significant reduction of all these secretory parameters (Table 1). The