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ORIGINAL ARTICLE

Assessment of Antisecretory, Gastroprotective, and *In-vitro* Antacid Potential of *Daucus carota* in Experimental Rats

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Abstract
Objectives: In Indo China, carrots have been reported to regulate the functions of the stomach and intestines. The objective of the present investigation was to unravel the therapeutic potential of 50% ethanol extract from *Daucus carota* roots (EDC) on antisecretory, gastroprotective, and *in vitro* antacid capacity using experimental rats.
Methods: Assessment of EDC antisecretory and *in vivo* antacid capacities was carried out using a pyloric ligation induced ulcer model. The gastroprotective effect was assessed with an absolute ethanol induced ulcer model. The integrity of gastric mucosa was evaluated using the estimation of glutathione and gastric mucus level and with histopathological examination of gastric mucosal cells. The *in-vitro* antacid capacity was evaluated using a titration method. The effect of the extract on the liver was assessed by measuring serum biochemical parameters.
Results: The EDC significantly ($p < 0.01$–0.001) reduced gastric lesions in both models. Furthermore, the EDC also significantly ($p < 0.05$–0.001) reduced the volume of gastric content whereas the total acidity was significantly ($p < 0.05$ –0.001) reduced with the doses of 100 mg/kg and 200 mg/kg EDC. Moreover, the mucus content and glutathione level increased significantly ($p < 0.05$) in the absolute alcohol-induced ulcer. The EDC also showed *in-vitro* antacid capacity. Histopathological studies further confirmed the potential of EDC by inhibiting congestion, edema, hemorrhage, and necrosis in gastric mucosa.
Conclusion: The EDC exerted antisecretory, gastroprotective, and *in vitro* antacid potential. These activities could be attributed due to the presence of glycosides, phenolics, tannins, alkaloids, and flavonoids.

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1. Introduction

Gastric ulcers are one of the major gastrointestinal disorders that occur due to an imbalance between the offensive (gastric acid secretion) and defensive (gastric mucosal integrity) factors [1]. Nowadays, there are two main approaches for curing peptic ulcers: the first approach is to reduce the gastric acid secretion and another approach is to reinforce the gastric mucosal protection [2].

Plants have been a valuable foundation of new drugs and considered as an alternative strategy in search for new drugs. There is a rich profusion of plants used in traditional medicine known to possess antiulcer properties [3]. *Daucus carota* L. ssp. *sativus* (family: Apiaceae) is an annual or biannual herb mostly confined to the temperate regions of Europe, Asia, and Africa [4]. In Indo China, carrots are used to regulate the functions of the stomach and intestines [5]. Pharmacologically, scientists have shown that the extract obtained from the *Daucus carota* possesses analgesic, anti-inflammatory [6], antifertility [7], antitumor [8], hepatoprotective [9] and hypoglycemic properties [10]. Patil et al [11] studied the anti-inflammatory effects on experimental colitis in rats. Extracts of umbels of *Daucus carota* L. ssp. *carota* were evaluated against ethanol induced gastric ulcer in rats [12]. Roots contain pyrrolidine, daucine [13], vitamin A, daucosterol, thiamine, riboflavin, nicotinic acid, vitamin C (in the form of protein-ascorbic acid complex), and vitamin D [14].

On the basis of literature review, the objective of the present investigation was to unravel the therapeutic potential of 50% ethanol extract from *Daucus carota* roots (EDC) antisecretory, gastroprotective, and *in-vitro* antacid capacity using experimental rats.

2. Materials and methods

2.1. Collection of plant material

The fresh roots of *Daucus carota* L *ssp. sativus* were collected from the Bazikhera of Unnao district belonging to Uttar Pradesh. The plant materials were taxonomically identified and authenticated by Dr D.C. Saini, Scientist E at Birbal Sahni Institute of Palaeobotony, Lucknow with reference no. 13597.

2.2. Preparation of the extract

The fresh roots (1 kg) of *D. carota* were peeled, washed, cut into small pieces, and homogenized in a blender without adding water. They were first defatted with petroleum ether and then extracted with 50% ethanol using a soxhlet extractor. The ethanol extract was filtered and the filtrate was dried in a rota evaporator to yield 20.23% w/w. EDC roots were stored in a desiccator for further preliminary phytochemical screening and pharmacological evaluation.

2.3. Preliminary phytochemical studies

The extract obtained was subjected to preliminary qualitative tests for various plant constituents using suitable chemical tests [15,16].

2.4. Animals

Wistar albino rats of either sex were obtained from the animal house of the department. They were housed in an environmentally regulated room on a 12 hours light:12 hours dark cycle at 25 ± 2°C, and had free access to food and water. The experimental protocol was approved by the Institutional Animal Ethics Committee of the Institute and experiments were conducted according to the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), India (CPCSEA-837/ac/2004) guidelines on the use and care of experimental animals.

2.5. Acute toxicity study

Different doses [5 mg/kg, 50 mg/kg, 300 mg/kg, and 2000 mg/kg, by mouth (p.o.)] of EDC were given to the animals and were used to study acute toxicity in accordance to Organization for Economic Cooperation Development [17] guideline 423. Three female rats, each sequentially dosed at intervals of 48 hours, were used for the test. Once daily cage side observations included changes in skin, fur, eyes, mucous membrane (nasal), autonomic (salivation, lacrimation, perspiration, piloerection, urinary incontinence, and defecation), and central nervous system (drowsiness, gait, tremors, and convulsions) changes. Mortality, if any, was determined over a period of 2 weeks.

2.6. Selection of doses

For the assessment of activity, two dose levels were chosen in such a way that the high dose was approximately one-tenth of the maximum dose during acute toxicity studies, and a low dose, which was 50% of the one-tenth dose (100 mg/kg, 200 mg/kg, p.o.).

2.7. Pharmacological assessment

Assessment of EDC as an antisecretory and *in-vivo* antacid was carried out with a pyloric ligation induced ulcer model. The gastroprotective effect was assessed with an absolute ethanol induced ulcer model. Integrity of the gastric mucosa was evaluated with the estimation of glutathione (GSH) and gastric mucus level and using histopathological examination of gastric mucosal cells. The *in-vitro* antacid capacity was evaluated using a titration method. The effect of the extract on the liver was assessed by measuring serum biochemical parameters.

2.8. Pyloric ligation induced ulcers

EDC in doses of 100 mg/kg and 200 mg/kg and ranitidine of 50 mg/kg were administered orally for 7 days in their respective groups. The control group of animals