Saudi Pharmaceutical Journal (2017) **25**, 387–396

King Saud University

Saudi Pharmaceutical Journal

www.ksu.edu.sa
www.sciencedirect.com

ORIGINAL ARTICLE

Prophylactic and curative anti-ulcerogenic activity and the possible mechanisms of action of some desert plants

Reham M. El-Meligy [a], Amani S. Awaad [b,*], Gamal A. Soliman [c], Sanaa A. Kenawy [d], Saleh I. Alqasoumi [e]

[a] *Department of Medicinal and Aromatic Plants, Desert Research Center, Cairo, Egypt*
[b] *Department Pharmacognosy, Faculty of Pharmacy, Prince Sattam Bin Abdul Aziz University, Al-Kharj, Saudi Arabia*
[c] *Pharmacology Dept., College of Pharmacy, Al-Kharj University, Al-Kharj, Saudi Arabia*
[d] *Pharmacology and Toxicology Department, Faculty of Pharmacy, Cairo University, Egypt*
[e] *Department of Pharmacognosy, College of Pharmacy, King Saud University, Saudi Arabia*

Received 24 August 2016; accepted 8 October 2016
Available online 19 October 2016

KEYWORDS

TNF-α;
Conyza dioscoridis;
Sisymbrium irio;
Gastrin;
MDA;
Reduced GSH

Abstract The present study aimed to evaluate the anti-ulcerogenic activities and the possible mechanisms of action of seven desert plants from different families. *Conyza dioscoridis* (L.) Desf. (Asteraceae), *Euphorbia hirta* L. (Euphorpiaceae), *Origanum syriacum* L., *Salvia* lanigera L. (Lamiaceae), *Sisymbrium irio* L., *Solanum nigrum* Linn. (Solanaceae) and *Solenostemma arghel* (Del.) Hayne. (Asclepiadaceae), were tested using prophylactic and curative models of absolute ethanol-induced ulcer, at three doses (125, 250 & 500 mg/kg) of each extract.

The investigated extracts possessed dose dependent anti-ulcerogenic activities in both models, with LD_{50} higher than 5 g/kg. The most effective extracts were *C. dioscoridis* and *S. irio* with percent protection of control ulcer; 91.1% and 85.4% respectively. The antisecretory activity of both *C. dioscoridis* and *S. irio* appears to be mainly related to the suppression of gastrin release. The *in vitro* potential radical (DPPH) scavenging activities of the investigated extracts were well supported with the reduction in gastric MDA (50.6% and 43.3%) and enhancing the level of reduced GSH (2.84, 2.59 mg/g tissue) for *C. dioscoridis* and *S. irio* respectively. In addition, suppression of the inflammatory mediator TNF-α may be one of the possible mechanisms of action. The alcohol extracts of *C. dioscoridis* and *S. irio* showed no alteration on liver and kidney functions.

* Corresponding author at: Pharmacognosy Department, College of Pharmacy, Prince Sattam, Saudi Arabia.
E-mail address: amaniawaad@hotmail.com (A.S. Awaad).
Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.jsps.2016.10.008

Phytochemical screening of the investigated extracts revealed the presence of flavonoids, tannins and sterols which could be related to the activities.

1. Introduction

Peptic ulcer is a disease among the most dominant chronic diseases that affect the world's population. It develops when there is an imbalance between the aggressive and protective factors at the luminal surface of the epithelial cells (Kalant et al., 2007). The principal factors causing this disease are inadequate dietetic habits, prolonged use of non-steroidal anti-inflammatory drugs, stress and infection by *Helicobacter pylori*, in addition to other factors of genetic origin. Characteristic features include epigastric pain, nocturnal pain and vomiting (Waller et al., 2005).

Several classes of pharmacological agents have been proved effective in the management of the acid peptic disorders, these groups include Antacids, antisecretory drugs (Proton pump inhibitors, antihistaminic (H_2) and anticholinergic (M_1)) and cytoprotective (sucralfate and prostaglandin analogues) agents (Julian and David, 1962; Katzung, 2004) in addition to antimicrobial for eradication of *H. pylori* (Kalant et al., 2007).

In the search of new anti-ulcerogenic agents, special interest has been directed to the herbal based products. Many plant extracts and natural isolated compounds were reported to have potential anti-ulcerogenic activity (Awaad et al., 2013).

The investigated extracts were reported to possess variable pharmacological properties. Anti-inflammatory and analgesic activities were reported for *C. dioscoridis*, *O. syriacum* (Awaad et al., 2011), *E. hirta* (Martinez et al., 1999; Lanhers et al., 1991) and *S. nigrum* (Zainul et al., 2006). Both *C. dioscoridis* and *E. hirta* extracts showed anti-diarrheal (Atta and Mounier, 2004; Galvez et al., 1993), antidiabetic (Shabana et al., 1990; Kumar and Rashmi, 2010) and antimicrobial activities (El-Hamouly and Ibrahim, 2003; Rajeh et al., 2010). Four extracts were potential antioxidants: *C. dioscoridis S. nigrum*, *S. lanigera* and *O. syriacum* (Awaad et al., 2011; Karmakar et al., 2010; Tenore et al., 2011; Alma et al., 2003).

Solanum nigrum extract is a potent antiulcerogenic agent with H^+/K^+ATPase inhibitory activity (Jainu and Shyamala, 2006) in addition to its hepatoprotective potential (Raju et al., 2003).

2. Material and methods

2.1. Plant materials

The aerial parts of seven desert plants from different families (*Conyza dioscoridis* (L.) Desf. (Asteraceae), *Euphorbia hirta* L. (Euphorpiaceae), *Origanum syriacum* L. and *Salvia lanigera* L. (Lamiaceae), *Sisymbrium irio* L., *Solanum nigrum* Linn. (Solanaceae) and *Solenostemma arghel* (Del.) Hayne. (Asclepiadaceae)) were collected from certain localities in Egyptian deserts in spring during flowering stage of 2012.

The samples were kindly identified by Dr. Ahmed Morsy, Professor of Botany, Desert Research Centre and compared with the published plants description (Täckholm, 1974; Boulos, 2000). Voucher specimens have been deposited in the herbarium of Desert Research Centre. Plant materials were air-dried separately in shade, reduced to fine powder, packed in tightly closed containers and stored for phytochemical and pharmacological studies.

2.2. Animals

Swiss albino mice of both sex (26–30 g) and male Wistar rats (180–200 g) were used. Animals were maintained under standard conditions (temperature 23 ± 1.0 °C, humidity 55 ± 10%, 12 h light/12 h dark cycle) and housed in standard polypropylene cages with wire mesh top and they fed with a standard pellet diet with water *ad libitum* and were allowed to adapt to the laboratory environment for one week before experimentation.

2.3. Extraction

For each plant, three hundred grams were separately extracted using ethanol (95%) in a Soxhlet apparatus till complete exhaustion. The total alcohol extracts were concentrated under reduced pressure at a temperature not exceeding 35 °C to yield a dry extract. The residue obtained for each extract was weighed.

Known weight of each extract was freshly prepared by dissolving in distilled water or suspending by the aid of few drops of Tween 80 just before the administration.

2.3.1. Phytochemical screening

Powdered samples from the aerial parts of the investigated plants were subjected to preliminary phytochemical screening according to the published methods (Trease and Evans, 2002; Sofowora, 1993; Harborne, 1973).

2.4. Acute toxicity (LD_{50}) test

Swiss albino mice in groups of six, received one of 100, 500, 1000, 2000, or 5000 mg/kg doses of the extracts to be tested. Control animals received the vehicle and were kept under the same conditions. Signs of acute toxicity and number of deaths per dose within 24 h were recorded for determination of oral median lethal dose, LD_{50} (Lorke, 1983).

2.5. Anti-ulcerogenic activity

Two sets of male Wistar rats were used in this study: the first set was for the prophylactic model, while the other set was designed for the curative model. In each set, 24 groups each of 6 animals were used. Rats of groups 1 and 2 received the vehicle (5 mL/kg) and served as normal control and ulcer control groups. Group 3 administered lansoprazole (30 mg/kg) and served as Reference Drug group. Rats of groups 4–24