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Full Length Article

Mitigating effect of *Avicenna marina* on indomethacin induced gastric ulcer in male albino rats

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ABSTRACT

The aqueous extract of *Avicenna marina* (AM) has been suggested to be useful in the treatment of various diseases. In this study, the protective effect of oral administration of *Avicenna marina* extract against oxidative gastric mucosal injury induced by nonsteroidal anti-inflammatory drugs (NSAIDs), indomethacin in rats was investigated. The aqueous extract of *Avicenna marina* was given by oral gavages (125 mg/kg) three times at 12 h intervals before administering indomethacin (20 mg/kg). The level of prostaglandin (PGE₂) and pH gradient were markedly decreased following indomethacin treatment, with increase in acid volume. In addition, tumor necrosis factor (TNF α), transforming growth factor- β 1 (TGF- β 1) and the lipid peroxidation products malondialdehyde (MDA) were significantly increased 6 h after oral administration of indomethacin in rats gastric mucosa indicating acute inflammatory injury. Pretreatment with AM abolished indomethacin induced elevation of TNF- α , TGF- β 1 and MDA levels. In indomethacin-treated rats, the superoxide dismutase (SOD) and catalase (CAT) activities as well as reduced glutathione (GSH) content were significantly diminished in gastric mucosa. However, pre-administration with AM maintains the level of these parameters near to the control value. Thus, these results indicate the effective anti-peroxidative and preventive actions of AM against indomethacin-induced gastric mucosal damage.

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1. Introduction

Harmful effects of toxic factors such as alcohol, bile salts, and hydrochloric acids are prevented by biological structures within

the stomach. This high resistance to injuries relies on a number of physiological responses evoked by the mucosal lining against potentially harmful luminal agents, as well as the ability of rapidly repairing the mucosal damage after it occurs [1]. On the other hand, these protective mechanisms might be

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Abbreviations: AM, *Avicenna marina*; PMN, Polymorphonuclear granules; CAT, Catalase; PGE₂, Prostaglandin; GSH, Reduced glutathione; ROS, Reactive oxygen species; Indometh, Indomethacin; SOD, Superoxide dismutase; LPO, Lipid peroxidation; TGF- β 1, Transforming growth factor β 1; MDA, Malondialdehyde; TNF- α , Tumor necrosis factor α ; NSAIDs, Nonsteroidal anti-inflammatory drugs
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overcome by injurious factors and a gastric mucosal lesion may develop. Most of the deleterious effects on gastric mucosa are caused by nonsteroidal anti-inflammatory drugs (NSAIDs), which are considered one of the largely used pharmaceutical agents worldwide [2]. NSAIDs produce both helpful and antagonistic impacts fundamentally by hindering cyclooxygenase (COX) and subsequently diminishing the production of thromboxanes and prostaglandins, which are the mediators that signal inflammation and pain as well as mediating the physiological functions [3].

Indomethacin, which is a part of the NSAIDs family, activates polymorphonuclear granules and induce gastrointestinal damage in both animals and humans [4,5]. These kinds of pathologies are usually primarily due to damage of the mucosal cell membranes. Previously, reports have shown that the inhibition of prostaglandin synthesis is not the only mechanism responsible for gastric damage induced by indomethacin [6]. Also, indomethacin might act like a pro-oxidant catalytic and also initiate LPO by producing ROS, thereby interfering with the endogenous antioxidant systems of any mucosal cells [7].

Avicenna marina is a mangrove plant known as gray mangrove tree belonging to the family of *Avicenniaceae* [8,9]. Phytochemical screening of *Avicenna marina* aqueous leaf extract revealed the presence of alkaloids, flavonoids, carbohydrates, glycosides, tannins, triterpenoids, and steroids [10,11]. It has been found to possess major therapeutic activity such as antibacterial, anti-helminthic [12], antimicrobial [13], antiviral [14], antihuman immunodeficiency virus, anti-inflammatory, and antitumor activity [15]. Mangrove extracts can be a possible source of mosquito larvicides. Mangrove plants are also reported for their antioxidant, anti-dyslipidemia, antidiarrheal, anti-filarial, anti-ulcer effect, cardiotoxic properties, and antidiabetic effects [16]. Mangrove leaf extracts are nontoxic to humans and are environmentally friendly as they are less pollutant [17]. This study focused on the antiulcer activity of *Avicenna marina* aqueous leaf extract against indomethacin induced gastric ulceration. To the best of our knowledge, this is one of the first studies that reported the antiulcer effect of AM leaves extract.

2. Materials and methods

2.1. Experimental animals

Healthy male Albino Wister rats of about 175 ± 5 g were used throughout the study. The animals were acclimated to laboratory conditions of 20–22 °C with a 12-h light/dark cycle for two weeks before experimentation. All rats were fed with a standard pellet diet and water *ad libitum*. Care and use of animals were conducted under supervision of the animal Care Committee of Mansoura University, Egypt.

2.2. Cold percolation extraction method

Avicenna marina leaves were collected from (Makadi village, Hurghada region, Egypt) in August 2014. After drying the leaves, they were pulverized into fine powder using sterilized mortar and pestle. 200 g of crushed material was taken into 500 ml

of ethanol, kept on a rotary shaker at 120 rpm for 24 h. After shaking, it was filtered through layers of muslin cloth, centrifuged at 1500 rpm for 20 min (Sigma, Laborzentrifugen 2K15). Resultant extracts were evaporated and concentrated to dryness using the rotary evaporator at 45 °C. The powder was dissolved in sterilized water and stored at 4 °C [18].

2.3. Experimental design

The animals were deprived of food for 36 hours before the experiment but had free access to water. Then NSAIDs, indomethacin was used as the ulcerogenic agent by a single dose of 20 mg/kg of body weight [19]. Rats were divided into 4 groups, each of 8 animals. The first group did not receive any treatment and served as a control. The second group, animals were orally administered with aqueous extract of *Avicenna marina* with a dose of 125 mg/kg body weight thrice in 12 hours interval [20]. The third group, animals received a single dose of indomethacin orally as 20 mg/kg of body weight. The fourth group, animals were orally administered with aqueous extract of *Avicenna marina* with a dose 125 mg/kg body weight thrice in 12 hours intervals; after one hour of last administration of AM, animals received a single dose of indomethacin orally as 20 mg/kg of body weight. After 6 hours of NSAID administration, the animals were sacrificed by cervical dislocation. The animals were dissected and the stomach was taken out, the stomach was opened along the greater curvature and washed by saline solution. Then, the stomachs were photographed and the mucosa was exposed for evaluation.

2.4. Biochemical analysis

Biochemical parameters, including malondialdehyde (MDA), reduced glutathione (GSH), superoxide dismutase (SOD) and catalase (CAT), were assayed using biodiagnostic kits, Dokki, Giza, Egypt. Tumor necrosis factor (TNF- α) level was estimated using an ELISA Kit (Diagnostic Products Corp., Los Angeles, CA, USA). Transforming growth factor β 1 (TGF- β 1) level was estimated by flow cytometric analysis. The prostaglandin E2 (PGE₂) level was quantified with an immune-enzymatic dosage kit from R&D Systems (USA).

2.5. Animal handling

The stomachs were removed and the gastric contents were collected and drained into a graduated centrifuge tube and centrifuged at 2000 x g for 15 min using Centurion Scientific Ltd centrifuge. The supernatant volume and pH were recorded with digital pH meter (intelligent meter YK-2001 pH).

2.6. Histopathological study

For histopathological examination, part of the gastric tissue was removed and was fixed in 10% formalin. After complete fixation, thin sections were prepared from tissues. Xylo and Hematoxylin-Eosin was used for clearing and staining, respectively. The slides were examined by microscope.

2.7. Statistical analysis

All results obtained from the study were evaluated by one-way ANOVA test, and post-comparison was carried out with

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