

Research Article

Ulcer Preventive Properties of Boerhaavia Diffusa on Acetyl Salicylic Acid/Pylorus Ligated Ulcer Model in Rats

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Abstract

Ulcer protective activity of ethanol and water extract of Boerhaavia diffusa was studied in albino rats. The ethanol extract at two different doses of 400 and 800 mg/kg showed marked protection of the gastric mucosa on acetyl salicylic acid /pylorus ligated ulcer model. Whereas, the water extract was ineffective. Photochemical screening of ethanol and water extract has been carried out. The ulcer protective effect of ethanol extract may be due to increase in the gastric mucosa. Histological evidence supports the protection of gastric mucosa by the ethanol extract treatment.

Keywords: boerhaavia diffusa; antiulcer; gastroprotective; pharmacology; albino rat

Introduction

Boerhaavia diffusa Linn. (Nyctaginaceae) is a common weed grown throughout India. The plant is herbaceous, stems prostrate and ascending divaricately slender, cylindrical, and thickened at the nodes. The root of B. diffusa is known for its diuretic properties. The leaves have a sharp taste, appetizer, used in ophthalmia and for the treatment of joint pains [1].

Phytochemical studies on B. diffusa revealed the presence of punarnavine [2] hypoxanthin-9, 1-arabinofuranoside [3], a new C-methyl flavone [4] and ecdysone [5] were isolated from the roots. Even though the plant is known for large number of biological activities [1] but, no systematic biological evaluation has been carried out. Hence, in our present investigation we subject the plant B. diffusa for its antiulcer potential against acetyl salicylic acid/pylorus ligated ulcer model.

Experimental

Collection and Extraction of Plant Material

The fresh whole plant of B. diffusa was collected in and around Gulbarga University campus, Gulbarga during August/September 2009 and authenticated at the herbarium (Voucher No.HGUG-599), Department of Botany, Gulbarga University, Gulbarga. The whole plant of B. diffusa was shade dried powdered (400 g) and subjected to extraction successively with ethanol (95%) and distilled water in a soxhlet extractor. The extracts were concentrated to dryness in a flash evaporator under reduced pressure and controlled temperature (40-600C). Ethanol extract yielded brown gummy solid (15 g) and water extract yielded a dark solid (20 g). The extracts were stored in refrigerator and tested separately for their phytochemical and antiulcer activity.

Phytochemical Screening

Ethanol and water extracts were screened for their phytochemical studies [6].

Antiulcer Activity

Healthy albino rats of either sex weighing between 150-200 g were taken for antiulcer activity [7]. Animals were fasted for 24 h before the experiment but water was given ad libitum. The rats divided into five groups of six animals each. Group I received Tween-80 (1%, 1ml/rat) which served as vehicle control, Group II received ranitidine at a dose of 50 mg/kg body weight, Group III and IV administered with ethanol extract, at a dose of 400 and 800 mg/kg body weight, respectively.

Group V received distilled water extract at a dose of 400mg/kg body weight. All the groups received the respective doses orally for a period of six days. The ulcer inducing agent acetyl salicylic acid at a dose of 200 mg/kg was administered orally, 30 min. after the administration of drug each day. On the 6th day, after the administration of last dose, the abdomen was opened and the pylorus was ligated under ether anesthesia. After 4 h of pylorus ligation, the contents of the stomach were collected carefully and centrifuged at 5000 rpm for 10 min. The supernatant was collected and volume of the gastric juice expressed as ml/100 g of body weight. To determine the acidity, the supernatant was titrated with NaOH (0.01N) using Topfer's reagent and phenolphthalein as indicators for free and total acid content, respectively. The stomach was cut opened along the larger curvature, washed with Luke warm saline and the ulcer lesions were noted through a dissecting microscope. The ulcer index was calculated for each stomach according to the following scale: 0, absence of damage; 1, redness of mucosa; 2, erosion; 3, ulcer.

Histological Study

Histological section of gastric glandular mucosa was cut opened and processed for paraffin sections following fixation in 10% formalin. Sections of 5 μm thickness were stained with eosin and counter stained with heamatoxylin [8].

Statistical Analysis

In order to assess possible significant differences between the mean values, student 't' test was used when the two population variances were different [9]. All data were expressed as Mean ± S.E.

Results

The Phytochemical screening (Table 1) of ethanol extract showed the presence of alkaloids, steroids, glycosides flavonoids and phenolics, where as water extract showed the presence of saponins and glycosides.

Table 1: Phytochemical screening of *Boerhaavia diffusa* L. extracts

Plant Constituents	Ethanol extract	Water extract
Alkaloids	+	-
Steroids	+	-
Flavonoids	+	-
Phenolics	+	-
Glycosides	+	+
Saponins	-	+

-, Absent

+, Present

Antiulcer activity (Table 2) ethanol extract of *B. diffusa* at a dose of 800mg /kg showed promising antiulcer activity and results are comparable with ranitidine treated group in the case of acetylsalicylic acid /pylorus ligated ulcer models. The mean ulcer score, pH of the gastric juice, free acidity and volume of the gastric content of ethanol extract treated group at 800 mg /kg was comparable with that of ranitidine treated group. Similar effects were observed in the ethanol extract treated group at 400 mg /kg body weight but the activity was lower when compared to 800 mg /kg dose. The water extract treated group was not effective. In any of the parameters accessed. The activity exhibited by ethanol extract was dose dependent.

Table 2: Antisecretory and ulcer protective effect of *Boerhaavia diffusa* L. extracts

Groups	Animal weight (gm)	Treatment	Dose (mg/kg)	Volume of gastric content (ml)	p ^H	Free acidity meq/1/100g	Total acidity meq/1/100g	Mean ulcer score
I	170	Tween-80 (Control)	1 ml (1%)	2.20 ±0.02	2.70 ±0.2	40.00 ±2.7	72.50 ±2.5	1.34 ±0.28
II	180	Ranitidine (Standard)	50	1.20 ±0.08	5.18* ±0.80	10.30* ±0.61	42.00* ±0.73	0.33* ±0.16
III	178	Ethanol extract	400	1.70 ±0.65	4.50* ±0.05	20.00* ±0.23	85.50 ±0.60	0.45* ±0.09
IV	176	Ethanol extract	800	1.10 ±0.51	5.03* ±0.32	15.33* ±1.14	53.83* ±0.51	0.32* ±0.05
V	180	Water extract	400	1.92 ±0.06	2.80 ±0.2	39.00 ±2.6	78.00 ±0.34	1.27 ±0.38

Duration: 6 days

Values are mean $\pm$ S.E

* $P < 0.05$ when compared to control

Histological sections of the gastric mucosa of the Tween-80 treated control rats showed severe erosion of the surface epithelium and oedema of the submucosal layers. The mucus secreting surface epithelial cells were absent. The ranitidine 50 mg/kg and ethanol extract at 800mg /kg treated group showed reduction in the erosion of the surface epithelial cells. The integrity of these cells was well maintained in these groups. But at the dose of 400mg /kg there were slight erosion of the surface epithelial cells. The water extract treated group did not show any marked protection on the surface epithelial cells. The mucus secreting surface epithelial cells were absent, except where there were no lesions when compared to the control group.

Discussion

Aspirin and other non-steroidal anti-inflammatory drugs are associated with gastrointestinal symptoms and injury to gastroduodenal mucosa. Acute injury ranges from subepithelial hemorrhage to erosion and ulceration [10-12]. On a chronic basis, these agents are associated with gastric ulcer [13-14] and with complications such as bleeding and perforation from both duodenal and gastric ulcers [15-17]. Elderly patients appear to be particularly vulnerable to these complications, which often arise without antecedent symptoms [18].

Aspirin inhibits the synthesis of prostaglandins [19]. This may result in gastroduodenal injury by disrupting the balance between damaging agents such as acid and pepsin and the mucosal defense. Oral replacement of prostaglandins has been proposed to prevent aspirin injury. Although in most of the cases the etiology of the ulcer is unknown, it is generally accepted that it results from an imbalance between aggressive factors and the maintenance of the mucosal integrity through the endogenous defense mechanism [20]. To regain the balance, different therapeutic agents including plant extracts are used to exhibit the gastric acid secretion or to boost the mucosal defense mechanism by increasing mucus production, stabilizing the surface epithelial cells, or interfering with the PGs synthesis [21].

The primary therapeutic approach of anti-ulcer agents involves maintenance of a delicate balance of factors controlling the synthesis, secretion and breakdown of its proteins, glycoproteins and lipid components, so as to strengthen the mucosal integrity [22]. The present investigation shows that the activity exhibited by the ethanol extract was dose dependent. It antagonized the aggressive factors, which play a crucial role in the pathogenesis of gastric lesion and augment defensive factors to protect the gastric mucosa from injury. The mucoprotection appears to be the major mechanism of its action in preventing gastric ulcers in experimental ulceration. The ethanol extract at 800mg/kg body weight showed marked reduction in the mean ulcer score, in the secretion of gastric juice and increase in pH of the gastric juice, which is better than, the ranitidine treated group. The superiority of ethanol extract over ranitidine treated group indicate the production of PGs by the extract which intern protect the gastric mucosa by increase in the secretion of the mucin from the mucus secreting cells, which are intact even by the onslaught of aspirin. Histological evidence supports the protection of the gastric mucosa by the presence of mucus secreting surface epithelial cells and no oedema in the submucosal layers.

The acidity exhibited by the ethanol extract may be due to the presence of flavonoids, which are in maximum concentration. The presence of the some polyhydroxy flavones in the extract may be the reason for the protection of the gastric epithelium. In conclusion, this is the first evidence that *B. diffusa* exerts a potent gastroprotective activity against on acetyl salicylic acid/pylorus ligated ulcer model in rats, upon oral administration. Further the work is progress on the isolation of active molecules in the ethanol extract.

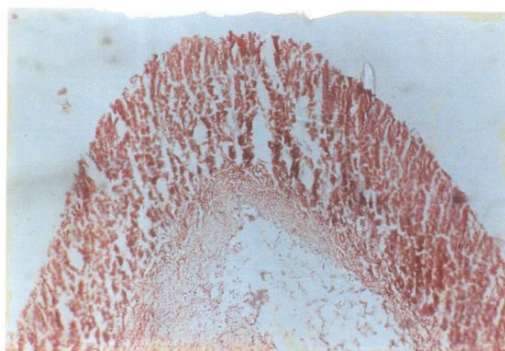


Figure1: Section of gastric mucosa of control rats showing uniform loss of mucus secreting epithelium and sub mucosal oedema.

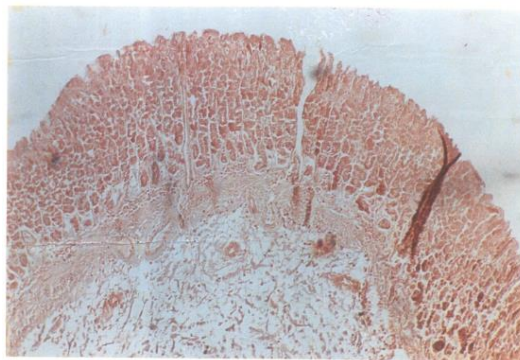


Figure 2: Section of gastric mucosa of ranitidine treated groups showing preservation of mucus secreting epithelium cells with no oedema.

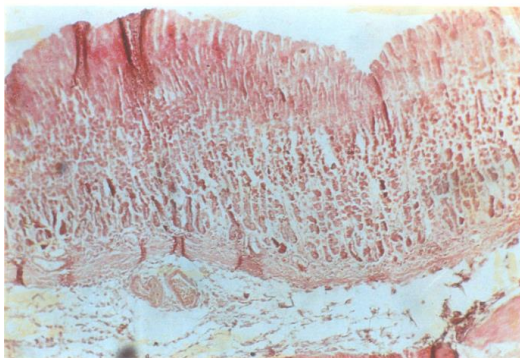


Figure3: Section of gastric mucosa of ethanol extract (400 mg/kg) treated group showing some ulcers and also preservation of mucus secreting epithelium cells with no oedema.

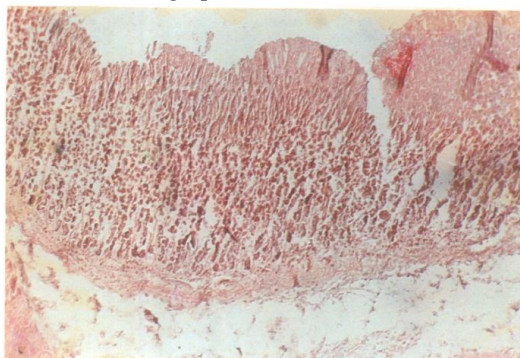


Figure4: Section of gastric mucosa of ethanol extract (800 mg/kg) treated group showing uniform preservation of mucus secreting epithelium cells with no ulcer.

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