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Original Research Article

Protective Effects of *Salacia lehmbachii* Aqueous Root Bark Extract Against Gastric Ulcer in Wistar Rats

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Abstract: *Salacia lehmbachii* is being used in traditional medicine for the treatment of gastric ulcer, this claim has not been scientifically substantiated or refuted. This work was therefore, designed to validate the antiulcer potential of the aqueous root bark extract of *S. lehmbachii* on stress induced and ethanol induced gastric lesions in rats. Phytochemical analysis and acute toxicity studies were also carried out. The extract (200 and 400 mg/kg) exhibited significant and dose dependent antiulcer effect in both models. The ulcer protection effect of the root extract is comparable to ranitidine. The root bark extract was found to be non toxic up to 5000 mg/kg dose level in rats. Phytochemical analysis identified flavonoids, tannins, saponis, alkaloids, terpenoides and flavonoids. The study provides strong evidence of antiulcer activity of *S. lehmbachii* aqueous root bark extract against gastric acid ulceration in rats.
Keywords: Aqueous extract; Root; Anti-ulcer; *Salacia lehmbachii*; Rats

INTRODUCTION

Peptic ulcer is a disease condition that has continued to affect many people mostly in developing world [1]. There is discontinuity in the viscosity of the gastric and duodenal mucosa in this condition due to some medications such as NSAIDs, gastric acids and pepsin secretion [2]. Peptic ulcers progression are believed to be caused by numerous factors like reactive oxygen species (ROS), bile acids secretion, tumor necrosis factors (TNF α) and release of histamine [3, 4]. Gastric ulcer formation which is an imbalance of acids, bile salts, and pepsin (aggressive factors) and prostaglandin, nitric oxide and peptides, the defensive factors. Adverse reactions from these drugs call for the use of herbal medicines [5].

Salacia lehmbachii which is of the family celastraceae grows to a small tree of about three meters high, especially in tropical area of East, West and Central Africa [6]. There are diverse therapeutic applications of *S. lehmbachii* which justify its folkloric background. The leaf extract is used as an antipyretic, while the root extract exhibited anticholinergic and anti-infertility effects [7-9].

The aim of the present study is to determine the antiulcer activity of the aqueous root bark extract of *S. lehmbachii* in ethanol and stress induced models.

MATERIALS AND METHODS

Plant collection and identification

The roots were collected from Ukanafu, South-South, Nigeria and were identified by a taxonomist in the department of Botany, University of Calabar, Calabar, Nigeria. A voucher specimen number 688 was deposited at the herbarium of the University for future reference.

Extract preparation

The roots were thoroughly washed, cut into pieces and spread at room temperature to air-dry. Mortar and pestle were employed to grind root to powder. The root powder (350 g) was soaked distilled water for 48 h and carefully sieved. The resultant mixture was dried at a low temperature in an oven with a yield of 9.8%. This was stored and subsequently used for the experiment.

Phytochemical tests

The presence or absence of root extract secondary metabolites was examined in accordance with Harbrone [10] procedure.

Animals

Wistar rats of both sexes (180-220 g) were obtained from the animal experimental unit of Department of Pharmacology, University of Calabar. They were given rodent diet and water *ad libitum*. Experiments were performed in line with Guide for the Care and Use of Laboratory Animals of the National Institute of Health [11].

Acute toxicity study of the extract

The acute toxicity profile of the root extract was assessed to determine its safety using Organisation for Economic co-operation and Development guidelines [12]. The studies were done in two phases. Three groups of 3 rats in each cage were orally administered 100, 600 and 1000 mg/kg of the extract respectively. Observation for signs of toxicity and mortality was done at 4 hrs and 24 hours. Second phase where 2000, 3000 and 5000 mg/kg of the root extract were administered to the next three groups of 3 rats and equally monitored as earlier stated for 48 h and 72 h respectively.

Anti-ulcer activity of *S. lehmbachii* ethanol root bark extract

Ethanol induced ulcer model

The rats for this study were fasted for 36 h and randomly divided into 4 groups with six in each group. Group I received 20 ml/kg distilled water (control), group 2 received ranitidine 50 mg/kg and served as standard. The remaining 3rd and 4th group received 200 and 400 mg/kg of the root bark extract as previously reported [13]**.** The gastric ulcers in rats were caused by oral gavage administration of 1 ml 90% ethanol after 1 h of drug treatment. The animals were anaesthetized 1 h later with light ether inhalation and each rat stomach was incised and ulceration scored. Gastric juice was collected in test tubes, centrifuged for 10 min at 1000 r/m and each volume recorded. In this assessment, gastric juice pH was also noted by analyzing free and total acidity of the content with pH meter. The extract protective strength after treatments was calculated in percentage [14, 15].

Stress induced ulcers

This process was performed in rats of different sex by forcefully allowing them to swim in transparent cylinder, containing water to the height of 35cm and maintained at 25°C for 2 h. Rats used for the experiment were fasted for 36 h and grouped into 4 with each having 6 rats. Distilled water (20 ml/kg) and 50 mg/kg, ranitidine were administered to group 1 and 2, while 3 and 4 groups respectively received 200 and 400 mg/kg, p.o. of *S. lehmbachii* aqueous root bark extract. After 1 h of drug administration, animals were then allowed to swim in water for 2 h. They were later anaesthetized in ether anaesthesia and sacrificed. Each stomach was microscopically examined after opening the greater curvature for gastric ulcerations. Gastric juice were collected into tubes, centrifuged at 1000 r/m for 10 min and analyzed as earlier stated. Percentage protection of each animal through various treatments was calculated [16, 17].

STATISTICAL ANALYSIS

Findings were shown as mean ± SEM, and each data were subjected to one way analysis of variance (ANOVA) followed by Dunnet's *post hoc* test. Results were taken as significant at $P < 0.05$.

RESULTS

Phytochemical analysis

Phytochemical results of the screened aqueous root bark showed alkaloids, saponins tannins, terpenoides and flavonoids to be present

Acute toxicity tests

There were no lethality or toxic reactions witnessed all through aqueous root bark of *S. lehmbachii* study. Animals were calm and healthy throughout the period of observation. Results show the extract to be greater than 5000 mg/kg in rats.

Effect of ethanol induced gastric ulceration test

The effects of aqueous root bark extract of *S. lehmbachii* on ethanol induced gastric lesion are shown in Table 2. The root extract showed a reduction in the ulcer index at all the tested doses compared to the control group. The animals that received ranitidine showed significant ($P<0.05$) decrease in gastric lesion compared to control. Treatment with the root bark extract significantly ($P<0.05$) brought down free acidity, total acidity and gastric content volume. The pH was significantly ($P<0.05$) increased at the levels tested.

Effect of water immersion stress induced ulcers

The results of this study in Table 1 showed that S. *lehmbachii* root extract possessed antiulcer effects in stress ulcer formation. The extract decreased ulcer index, gastric volume, free acidity and total acidity, but increased the values of pH significantly ($P<0.05$) compared to control group**.** Hence, they show the antisecretary partway involved in its activity against ulcer. Ulcer parameter index was used for the test since factors like gastric volume; free acidity and total acidity are directly related to ulcer formation.

Table 1: Effect of aqueous root bark extract of *S. lehmbachii* on water immersion stress induced ulcer in rats.

Treatment	dose (mg/kg)	Gastric juice		Gastric acidity (mEq/L)		Ulcer index	% protection
		PH	Volume (ml)	Free	Total		
Control	20 ml/kg	5. 42±0.19	14.08±0.23	53.30±1.82	76.45±0.38	6.30±0.53	-
S. lehmbachii	200 mg/kg	4.22±0.12*	7.50±0.22*	24.53±0.20*	48.32±0.25*	2.80±0.32	56
S. lehmbachii	400 mg/kg	4.35±0.15*	7.25±0.17*	16.10±0.15*	27.22±0.13*	1.70±0.37*	73
Ranitidine	50 mg/k	3.15±0.10*	9.20±0.15*	33.10±0.05*	54.45±0.20*	1.20±0.45**	81

Values are expressed as mean ± SEM (n=6), significant at * P<0.05; ** P<0.01 when compared to control.

Table 2: Effect of aqueous root bark extract of *S. lehmbachii* on ethanol induced ulcer in rats.

Treatment	dose (mg/kg)	Gastric juice		Gastric acidity (mEq/L)		Ulcer index	% protection
		PH	Volume (ml)	Free	Total		
Control	20 ml/kg	5. 49±0.14	10.02±0.11	35.30±0.20	61.55±0.18	6.80±0.50	-
S. lehmbachii	200 mg/kg	4.22±0.12*	4.22±0.08*	20.20±0.13*	35.30±0.20*	3.25±0.28	52
S. lehmbachii	400 mg/kg	4.35±0.15*	2.40±0.12**	15.14±0.10*	28.19±0.15*	1.65±0.75*	76
Ranitidine	50 mg/k	6.10±0.05*	2.20±0.10**	7.15±0.02**	13.20±0.11*	1.00±0.56**	85

Values are expressed as mean ± SEM (n=6), significant at * P<0.05; ** P<0.01 when compared to control.

DISCUSSION

Peptic ulcer disease occurs as a result of an imbalance between aggressive factors and endogenous defense mechanism [18, 19]. Acid and pepsin are relatively less important causative agents, but defects in the defensive mechanism of the gastric mucosa are the first step toward ulcer formation. Different antiulcer agents are used to restore this imbalance due to their antacid properties [20]. Due to several adverse effects associated with currently used antiulcer drugs, attention have been directed towards herbal medicine as preferred alternatives for gastric ulcer treatment. The aqueous root bark extract showed dose dependent ulcer protective effects against the two used animal models.

In ethanol induced model, ulcers are caused due to perturbations of superficial epithelial cells, especially the mucosal mast cells, leading to the release of vasoactive mediators such as histamine and reactive oxygen species, resulting in the gastric mucosa damage [21]. Mucosal blood flow has been an essential factor in the damage caused by ethanol and is modulated by prostaglandin [22]. The potency of *S. lehmbachii* root bark extract in protecting mucosal damage caused by alcohol is an indication of the extract action on both prostaglandins synthesis and free radical scavenging activities. It has been also accepted that alcohol-induced ulcers are not only inhibited by anti-secretory agents such as ranitidine, but also by agents that enhance mucosal defensive factors [23].

Water immersion stress model exposes the animal to both physiological stress and emotional stress. *S. lehmbachii* root extract administration before stress induction decreased the incidence and severity of stress induced gastric ulcers in rats. It has been reported that acute stress induced gastric ulcers are caused by loss of the protective mechanism of the gastric mucosa [24, 25]. In this study, the presence of the extract might have acted as a barrier between gastric mucosa and the excessive gastric acid secreted during stress which may have stimulated blood flow to the stomach and inhibit stress induced ulcers. The aqueous root bark extract of *S. lehmbachii* **s**trongly reduced ulcer parameters on the test animal in a dose dependent manner with a significant increase in both the pH and percentage ulcer inhibition. Phytochemical screening of the extract showed it contains alkaloids, saponins tannins, terpenoides and flavonoids. It should be stated that the ability of aqueous root bark extract of *S. lehmbachii* to reduce acidity might be due to the presence of some phytocompounds such as tannins, terpenoids and flavonoids.

CONCLUSION

The aqueous root bark extract of *S. lehmbachii* has demonstrated potential activity against gastric ulcer and thus justify the uses of the plant (root bark) in ulcer treatment. Further studies are needed to elucidate the mechanism of action of gastric protection by the root bark extract.

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