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Antiulcer activity of hydroalcoholic extract of *Bombacopsis glabra* (Pasq.) A. Robyns. Leaves (Bombacaceae) in rat

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Abstract

The purpose of this study was to investigate the activity of the hydroalcoholic extract of*Bombacopsis glabra* leaves in rat. The mucoprotector effect of *B. glabra* leaves hydroalcoholic extract was studied by evaluating its ability to protect the mucosa from aggression of repeated oral administration of indomethacin at a dose of 30 mg/kg while pylorus ligature was used to study its anti-secretory effect.

The results show that hydroalcoholic extract of the leaves of *B. glabra*, at doses 300 and 600mg/kg, decrease the surface area of lesions induced by indomethacin from 6.2 $\pm$ 0.50 mm^2 observed in the control group animals to 2.51 $\pm$ 0.29 mm^2 and 1.19 $\pm$ 0.073 mm^2 respectively, in the treated animals ($p<0.05$). The extract decreases gastric acidity by increasing the pH of the gastric content from 1.7 $\pm$ 0.03 of the control animals to 2.27$\pm$ 0.09 and 3.59 $\pm$ 0.11 of the animals that received the extract at dose 300 and 600mg/kg respectively ($p<0.05$). These results show that the hydroalcoholic extract of *B. glabra* leaves possesses an anti-secretory effect and acts as a mucoprotector, and therefore has an antiulcer activity. The alkaloids, flavonoids, tannins, or polysaccharides in the extract could be responsible for this activity.

Keywords: Antiulcer; Indomethacin; Mucoprotector; Anti-secretory; Rat

1. Introduction

In Madagascar, stomach pain is a common disease, and affects 5% of Malagasy between 20 and 40 years old. And this pathology is more frequent in town than in rural area [1]. Gastric ulcer develops when digestive juices produced in the stomach are rich in*hydrochloric acid* and *pepsin*, the two major aggressive agents on the gastric lining. Fortunately, the body has a defense system to protect the stomach against these substances: the mucus layer rich in bicarbonate. Prostaglandins help widen the blood vessels in the stomach, to ensure good blood flow accelerating cell regeneration, and to stimulate bicarbonate and mucus production [2]. Anyone who takes non-selective NSAID (non-steroid anti-inflammatory drug) regularly is at risk of gastrointestinal ulcer, by inhibiting prostaglandins. Although stress is no longer considered to be a cause of ulcers, some studies still suggest that stress may predispose a person to ulcers, by increasing acid secretion or preventing existing ulcers from healing [3]. In 1982, two Australian scientists identified *H. pylori* as the main cause of stomach ulcers [4].

Antiulcer drug may reinforce the protective agents or reduce the aggressive ones. Topics and prostaglandin reinforce the protection of the gastric lining, while antiacid, antisecretory, and antibacterial reduce the aggressive agents [5].

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In Madagascar, people still use medicinal plants to take care of this disease, and the leaves, stem and bark of *Bombacopsis glabra* is one of the plants used to treat stomachache.

2. Material and methods

2.1. Extraction and phytochemical screening

The leaves of *B. glabra* were dried in shade, and ground. The powder was macerated in a mixture of ethanol and water (60v:40v) at room temperature, for 3 days. The macerate was filtered with Whatman paper (n°1) and evaporated to dryness with a vacuum evaporator (Büchi). This extract was subject of a phytochemical screening to detect the main compounds in it [6].

2.2. Experimental animals

Male rats weighing 250 to 275 g of Wistar strain, were used in this work. They were bred at the animal house of the Pharmacology and Cosmetology Laboratory of the Sciences Faculty, University of Antananarivo, with a 12/12 h light and darkness cycle, at a temperature around 20°C. They were fed with animal food LFL 1420 and had water *ad libitum*. The animals were fastened 18 h prior to tests. Fastened animals were divided into 4 groups: 1 control and 3 treated with the extract. The extract was dissolved in water, and the animals of the control group received 10 ml/kg of water by oral route, while the 3 other groups received the extract, respectively, at the doses of 150, 300 and 600 mg/kg in 10 ml/kg of water, orally [7].

2.3. Evaluation of the extract mucoprotective activity

Each morning, for 5 days, at the same hour, the animals of the control group received distilled water, and the other groups received the extract. After 1 hour, all the groups were given 30 mg/kg of indomethacin orally [8].On the 6th day, they were anesthetized with 100 mg/kg of barbituric *i.m*. Their stomachs were removed and cut opened along their long curvature and rinsed with water. The lesion surface area on the gastric wall was measured by direct planimetry, using a transparent millimetric paper [9].

2.4. Evaluation of the extract anti-secretory activity

One hour after administration of water and the extract at different doses to the animals of the 4 groups, they were anesthetized by diethyl ether inhalation. Laparotomy was carried out on the upper part of their abdomen. Once identified, the pylorus was ligatured, and the abdomen was sutured. The animals were put in individual cages for 6 h, during which they were deprived of food. After that period, they were anesthetized by inhaling diethyl ether, and a laparotomy was practiced, the esophagus was clamped, and the stomach was removed [10]. Each stomach content was put in a test tube and centrifuged at 3000 rpm for 10 min. The supernatant was recuperated, and its pH was measured with a pH meter (PIERRON ®).

2.5. Evaluation of the extract activity on mucus secretion

Every morning at the same time, for 10 days, the animals of the control group received 10 ml/kg of distilled water, and those of the other 3 groups received 150, 300 and 600 mg/kg of the extract, orally, in 10 ml/kg of distilled water. After 10 days, the animals were anesthetized by inhaling diethyl ether. Their stomachs were isolated and rinsed, and the mucus was grated and weighed [11].

3. Results

3.1. Mucoprotective activity of B. glabra extract

Repeated oral administration of indomethacin provokes lesions on the gastric wall. *B. glabra* extract administered orally reduces the lesion surface area on the rats' gastric wall. The surface area is equal to 8.02 ± 0.5 mm^2 in the control group, versus 3.88 ± 0.5, 2.3 ± 0.2 and 1.8 ± 0.3 mm^2 in the groups treated with the extract at the doses of 150, 300 and 600 mg/kg respectively ($p<0.05$) (Figure 1).

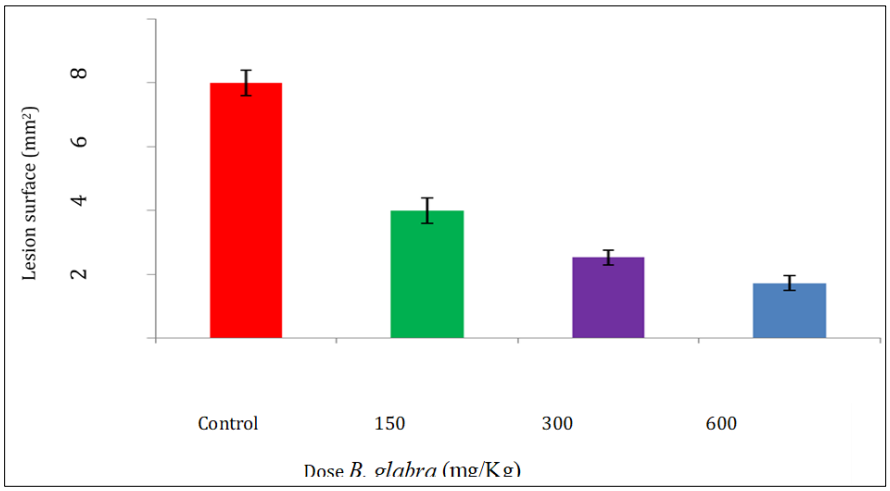

Figure 1 Variation of the lesion surface area on gastric wall of the animals in control group and those treated with *B. glabra* extract, administered orally, at the dose of 150 , 300 , and 600 mg/kg($\bar{X} \pm \bar{\sigma}$; $n = 6$; $p < 0.05$)

3.2. Effect of B. glabra extract on acid secretion

Pylorus ligation induces increase of gastric content's acidity. Administered orally *B. glabra* leaves extract reduces that acidity, pH of gastric fluid increases with the dose administered. In the control group the gastric fluid pH is equal to 2.10 ± 0.09 versus 2.5 ± 0.07, 4.10 ± 0.2 and 6.10 ± 0.07 in the animals treated with the extract at the dose of 150, 300 and 600 mg/kg respectively ($p<0.05$) (Figure 2).

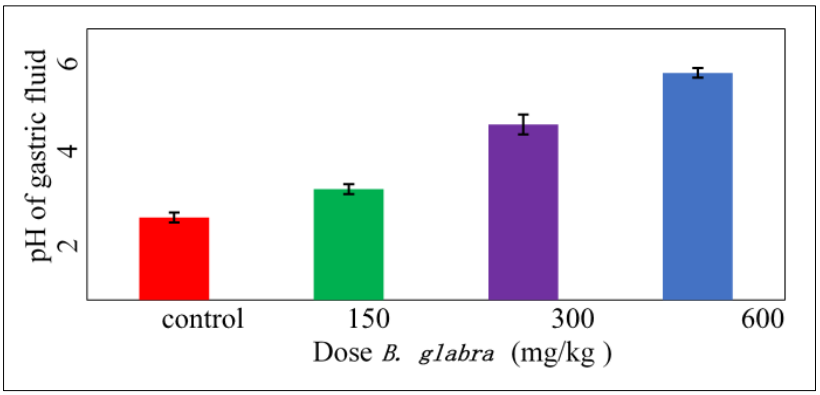

Figure 2 Variation of pH of gastric fluid of the animals in control group and those treated with B. glabra extract, administered orally, at dose 150 , 300 and 600 mg/kg ($\bar{X} \pm \bar{\sigma}$; $n = 6$; $p < 0.05$)

3.3. Effect of B. glabra extract on mucus secretion

Administration of the extract *per os*, once a day, for 10 days increases the quantity of mucus on the gastric wall. The weight of mucus is 32.5 ± 2.3 mg in the control group, versus 48.01± 2.3, 52.5 ± 0.12 and 69.05 ± 1.06 mg in the animals treated with the extract at dose 150, 300 and 600 mg/kg respectively ($p<0.05$) (Figure 3).

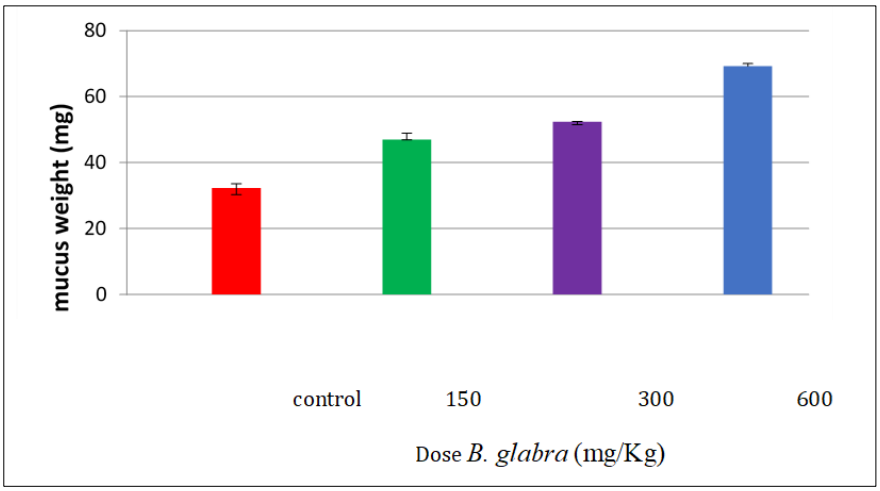

Figure 3 Variation of mucus weight of the animals in control group and those treated with B. glabra extract, administered orally, at the dose of 150 , 300 and 600 mg/kg ($\bar{X} \pm \bar{\sigma}$; n= **6** ; p< **0.05**)

4. Discussion

This work aimed to evaluate the anti-ulcer activity of the leaves of *Bombacopsis glabra*. Research was carried out on rat. The mucoprotective activity of *B. glabra* leaveswas evaluated for its capacity to protect the gastric wall from indomethacin induced lesions and for mucus secretion, while its activity on acid secretion was investigated by measuring pH of intra gastric fluid of the treated animals versus control group.

Indomethacin, which is a non-steroid anti-inflammatory was used in this work, because it producesdamage in stomach due to decrease of the mucosal prostaglandins PGE2 concentration [12]. Our results show that the hydro alcoholic extract of *B. glabra* leaves reduces indomethacin induced lesion surface area on the gastric wall. It might be due to the increase of the gastric wall protection which is assured by mucus and bicarbonate. The results that we got show that *B. glabra* leaves extract increases the mucus weight and the intra gastric pH. On the one hand, it also reduces the lesion surface area on the gastric wall; this might be due to acceleration of the wound healing process. Analyzing these results, one can advance a hypothesis that *B. glabra* leaves extract might increase prostaglandin synthesis [13]. Because endogenous PGE2 plays an important role in the protection of the gastrointestinal mucus; part of the mechanisms responsible for these effects of PGE2 is stimulation of $HCO3^-$ secretion as well as stimulation of mucus secretion [14]. Our results show that *B. glabra* leaves extract increases the pH of gastric fluid and the mucus weight. On the other hand, PGE2 is also involved in the healing of gastric ulcers by stimulation of VEGF in angiogenesis [14], this might be responsible for the decrease in the lesion surface area observed in the rat treated with the extract of *B. glabra.*

5. Conclusion

These results indicate that the hydro alcoholic extract of the leaves of *Bombacopsis glabra* increases the protection of the gastric wall, by reducing the intra gastric acidity and increasing mucus production. It might also accelerate the healing of the lesion induced by indomethacin. Increase of PGE2 might be responsible for its anti-gastric ulcer activity.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no conflict of interests.

Statement of ethical approval

The experimental protocols were approved by the Sciences Faculty Animal Care Ethics Committee (Ref: FacSc/CE013/22).

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