IOSR Journal Of Pharmacy
(e)-ISSN: 2250-3013, (p)-ISSN: 2319-4219
Volume 15, Issue 11 Series. I (November 2025), PP.12-16
www.iosrphr.org

Anti-gastric ulcer activity of *Perichlaenarichardii*Baill (Bignoniaceae) in rat

Solofoniaina Gabriel ANDRIAMALALA*[1],TianarilalainaTantely ANDRIAMAMPIANINA[1], Nathaniel QUANSAH[2], Fanantenanirainy RANDIMBIVOLOLONA[1],Patricia RANDRIANAVONY[1]

1Pharmacology Department, Sciences Faculty, University of Antananarivo, Madagascar
Corresponding Author: andriamalalas@yahoo.fr*
2School for International Training (SIT) Study Abroad Madagascar

Abstract: This work aimed to investigate the anti-gastric ulcer activity of the hydro alcoholic extract of Perichlaenarichardii leaves in rat. Its effect on gastric mucosa was studied on gastric lesions induced by orally administering indomethacin at dose 30 mg/kg for 5 days. Misoprostol, at the dose of 1.4 µg/kg, was used as reference, while the effect of extract P. richardii on acid secretion was investigated after pylorus ligation. The extract P. richardii reduces indomethacin induced gastric surface ulcerous lesions. The administration of the extract at doses 150 and 300 mg/kg results in the reduction of surface lesions from 18.33 ± 0.64 mm2 in the control group to 10.25 ± 0.48, 7 ± 1.66 and 3.83 ± 0.76 mm2 respectively, for animals treated with extract at doses 75, 150 and 300 mg/kg, and 5.66 ±0.14 mm2 for animals given misoprostol at the dose of 1.4 µg/kg ($p<0.05$). Extract P. richardii increases gastric fluid pH from 2.16 ± 0.14 in the control group animals to 3.33 ± 0.24 and 4.8 ± 0.29 respectively in animals treated with extract P. richardii at doses 150 and 300 mg/kg, and 5.79 ± 0.46 in animals treated with cimetidine 100 mg/kg ($p< 0.05$). These results indicate that extract P. richardii possesses an anti-ulcer activity. It protects the gastric mucosa in rats and reduces acid secretion induced by pylorus ligation. This activity could be attributed to the alkaloids, flavonoids or tannins present in the extract.

Keywords -anti-secretory,antiulcer, muco-protector, rat

I. INTRODUCTION

Gastric ulcer is characterized by mucosal damage occurs in the stomach by stress, alcohol, Helicobacter pylori and NSAIDs such as indomethacin, one of the most widely used NSAIDs[1]. Maintaining resistance of gastro duodenal mucosa is assured by a variety of physiological defences and its rapid repair in case of injury. The first defence consists of bicarbonate and mucous layer on the gastric mucosa. The bicarbonate ensures the neutrality of the gastric pH, the mucous layer protects the gastric mucosa from the proteolytic actions of pepsin. Continuous cell renewal maintains the integrity of the mucosa[2]. The imbalance between offensive and defensive factors contribute to mucosa ulceration[3].

Anti-gastric ulcer drugs either inhibit the offensive factors or boost the defensive factors. For centuries, medicinal plants have been used traditionally for the treatment of a large range of ailments, including gastrointestinal disorders. Some secondary metabolites such as flavonoids, alkaloids, saponins, tannins, and terpenoids are found to have anti-ulcer activity[4].

An ethnobotanical survey conducted by our team in the SOFIA region (northern part of Madagascar) reported that the leaves decoction of *P. richardii*, taken orally for on an empty stomach, heals the pain felt from gastric ulcer. This study aimed to verify the claims of the knowledge of native traditional medicine practitioners. Indomethacin induced ulcer and pylorus ligation have been used as models for the evaluation of anti-ulcerogenic activity of *P. richardii* in this work.

II. MATERIALS AND METHODS

2.1. Extraction

The leaves of P. richardii were collected from the northern part of Madagascar in November 2021. They were dried under shade, in an aerated room, at room temperature for 45 days, then ground and macerated in an ethanol/water mixture (60:40) at room temperature for 5 days. The macerate was filtered on Whatman paper n°2. The filtrate was centrifuged at 4 000 rpm, and the supernatant was evaporated to dryness under vacuum with a Rotavapor (BUCHI 240®) at 60°C. This extract was used for the phytochemical screening and the biological tests.

2.2. Phytochemical screening

Phytochemical screening of the hydro-alcoholic extract was carried out following the method described by Fong *et al*.using specific reactive for each chemical family that formed a precipitate and/or changed coloration in the presence of the corresponding chemical family[5].

2.3. Animals of experimentation

Albino rats, Wistar strain, of both sexes, aged from 4 to 5 months and weighing 180 to 200 g, were used during the experiments. The animals were bred in the animal house of the Laboratoire de PharmacologieGénérale, de Pharmacocinétique et de Cosmétologie of the Faculty of Science, University of Antananarivo at a temperature of 22 ± 2°C and kept under 12h/12h light/dark cycle. The animals were euthanized using 150 mg/kg of pentobarbital by intra peritoneal route[6]. The experimental protocol got approval from the Antananarivo Sciences Faculty Animal Ethics Committee under reference 12/2021. Misoprostol 1.43 µg/kg/day and cimethidine 100 mg/kg/day were used as standard drugs and served as a positive control. Indomethacin, at dose 30 mg/kg/day, served as the ulcerogenic agent.

2.4. Evaluation of the extract mucoprotective activity

Five groups of 5 rats were fasted 18 hours prior to tests and had free access to water. Each animal received indomethacin, orally, at the dose of 30 mg/kg daily for 5 days to induce gastric mucosa lesions. After this period, the control group was given distilled water; the second group, served as positive reference, and received misoprostol at the dose of 1.4 µg/kg (Sayanti B. and Susri R.C., 2007) while the remaining 3 groups respectively received 75, 150 and 300 mg/kg of the extract. The products were administered by oral route in a fixed volume of 10 ml/kg[7]. At the end of the treatment, the animals were euthanized with 150 mg/kg of pentobarbital by intra peritoneal route and exsanguinated. The animals'stomachs were isolated then cut open along the great curvature. The gastric wall was rinsed with water and observed under 10X magnification. The macroscopic lesions surface area were measured by direct planimetry method using transparent millimeter paper[8].

2.5. Evaluation of the extract anti-acid activity

The anti-acid activity of the extract was evaluated in vivo using pylorus ligation model[9]. The animals were divided into 5 groups of 5 rats and fasted for 18 hours before the experiment and had free access to water. The control group received distilled water, while the second group, used as positive control group, received cimetidine at the dose of 100 mg/kg[10] and the remaining three groups received the extract at a dose of 75, 150 and 300 mg/kg respectively. All the products were administered by oral route in a fixed volume of 10 ml/kg[7].

Thirty minutes prior to ligation process, the drugs were given orally. The animals were anesthetized by ether inhalation. Under light a midline abdominal incision was made, pylorus was ligated, and the wound was closed by points of suture. The rats were placed individually in separate cages to recover without food and water. After 8 hours of pylorus ligation, animals were euthanized using 150 mg/kg of pentobarbital by intra peritoneal route, and exsanguinated. A laparotomy was practiced, and their stomach was isolated and its content was collected in a centrifuge tube, then centrifuged at 3000 rpm for 10 minutes. The supernatant was collected, and its pH was measured using a pH meter[11].

2.6. Expression and Analysis of results

The results were expressed as mean ± sem. The data was analysed with ANOVA, and Student ''t''test. The difference was considered significant for a value of $p<0.05$.

III. RESULTS

3.1. Major chemical families in the extract

Phytochemical screening done on the extract has shown the presence of high content of alkaloids, average content of flavonoids, tannins, anthocyanins and terpenes and a low content of polyphenols .

3.2. Mucoprotective activity of the extract

Indomethacin was used as ulcerogenic agent, it was administered orally at the dose 1.4 µg/kg, once a day, for 5 days.This provokes an ulceration on gastric mucosa. The control animals had gastric mucosa lesions surface area of 18.33 ± 1.52 mm², whereas the animals treated with the extract at the dose of 150, 300, 600 mg/kg presented gastric mucosa surface lesions of 12.27 ± 0.85, 7.33 ±0.66 and 3.83 ± 0.76 mm² respectively. The extract shows a comparable effect as the reference drug. The animals that were given misoprostol 1.4 µg/kg presented mucosa surface lesion of 5.66 ±0.14 mm ^{2} ($p<0.05$) (Fig. 1). The reduction of the lesion surface indicates the mucoprotective activity of the extract.

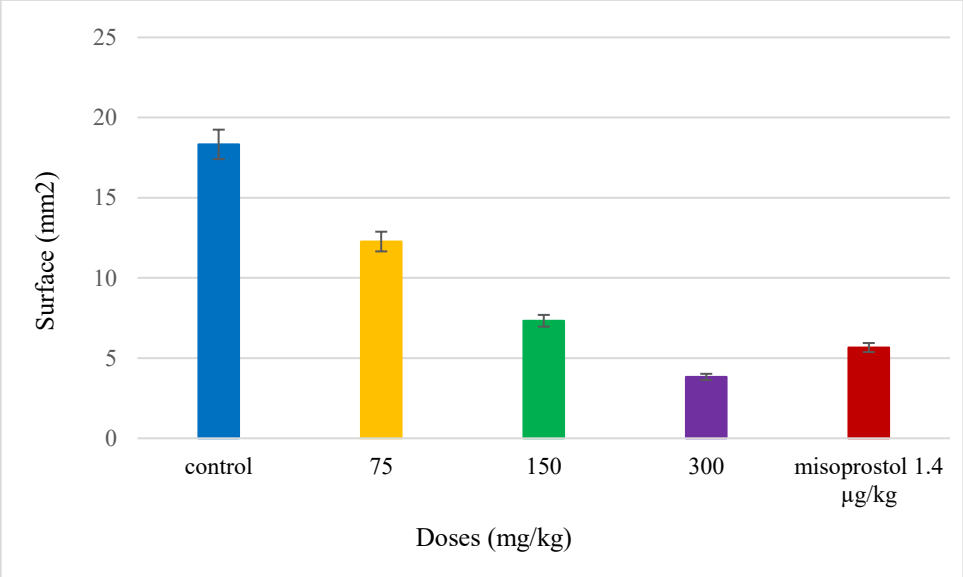

Fig.1: Lesion surface observed on gastric mucosa of control animals and treated animals with the extract at doses of 75 , 150 and 300 mg/kg and misoprostol at the dose 1.4 µg/kg ($\bar{x} \pm \bar{\sigma}$; n=5; p <0.05)

3.3. Effect of the extract on gastric acidity

Pylorus ligation induced gastric ulcer was used to investigate the effect of the extract on gastric acid secretion. Eight hours after pylorus ligation, the pH of the gastric content of the control animals is 2.16 ± 0.14, versus 2.8 ± 0.32, 3.3 ± 0.24, 4.89 ± 0.29 respectively for the animals treated with the extract at the dose of 75, 150 and 300 mg/kg, The gastric content pH of the animals treated with cimetidine is 5.79 ±0.46 ($P<0.05$) (Fig. 2). The increase of the pH value indicates the anti-acid activity of the extract.

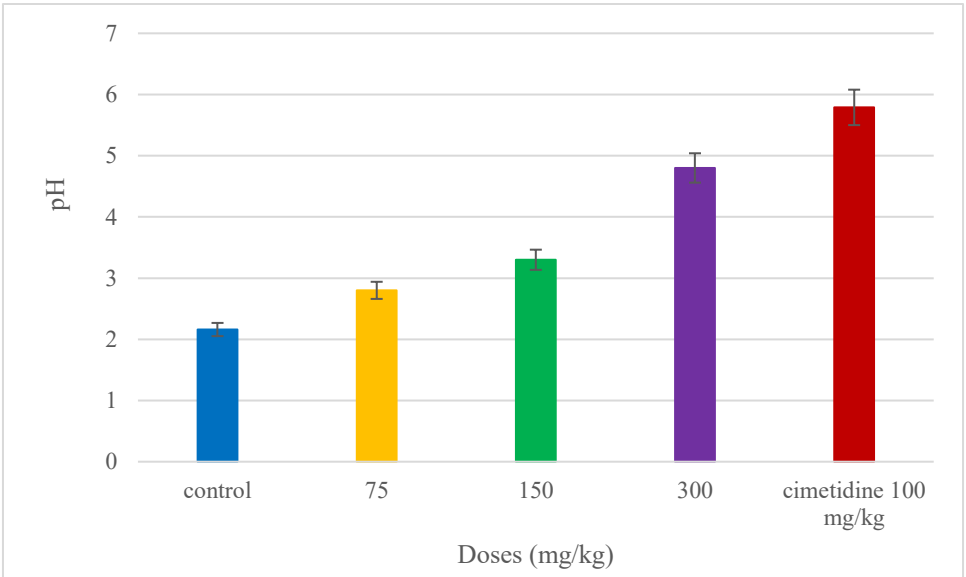

Fig. 2: pH of gastric content of control animals and treated animals with the extract at doses of 75 150 and 300 mg/kg and cimetidine at the dose 100 mg/kg ($\bar{x} \pm \bar{\sigma}$; n=5; p <0.05)

IV. DISCUSSION

The objective of this work was to evaluate the anti-gastric ulcer activity of *Perichlaenarichardii* Bail (Bignoniaceae) to authenticate its traditional use for stomach ache. This pathology is due to the imbalance between offensive and defensive factors of gastric mucosa, to the advantage of the aggressive ones. The protection is mainly assured by the mucus, bicarbonate, and adequate blood flow, while hydrochloride acid and pepsin corrode the mucosa. Anti-gastric ulcer medications either reduce the aggressive agents or increase the protection of mucosa. To attain the objective, the effect of the extract on mucoprotection and its effect on acid secretion were evaluated. Indomethacin was used as ulcerogenic agent, and pylorus ligation to induce gastric acid secretion.

Indomethacin, one of the most widely used NSAIDs, was used as ulcerogenic agent in this work. This drug inhibits COX-1 responsible for the synthesis of prostaglandins E1 which have been shown to inhibit gastric acid secretion, increase gastric blood flow, and stimulate bicarbonate and mucus secretion, hence protecting gastric mucosa against aggressive agents. While indomethacin, by inhibiting prostaglandins synthesis leads to ulcer formation on gastric lining. Misoprostol which is a synthetic prostaglandin E1 analogue was used as standard reference drug in this work[12].

Acetylcholine, gastrin, and histamine are the three stimulants of gastric acid secretion. Acetylcholine is released by vagal and intramucosal reflex stimulation, acting directly on the parietal cell. Pylorus ligation stimulates the antral sympathetic nervous system, releasing acetylcholine which increases gastric acid secretion. Acid secretion response to pylorus ligation is inhibited by muscarinic blocker[13]. Cimetidine that we used as reference drug, competitively blocks histamine from stimulating its H2-receptors located on the gastric parietal cells, responsible for gastric acid secretion. This competitive inhibition results in reduced gastric acid secretion, explaining the pH increase during the test we have conducted with the pylorus ligation[14].

Treatment with the extract compared to the negative control, exhibited significant reduction in lesion on gastric mucosa surface, similar to misoprostol, used as standard drug in this work. These results indicate that the extract increases the gastric mucosa protection. On the other hand, the increase of pH value indicates the reduction in gastric content acidity, which demonstrates extracts'capacity to reduce the aggressive factors. This could be due to either an increase in bicarbonate secretion or in decrease of acid secretion. Since pylorus ligation stimulates the parasympathetic nervous system, increase of pH might partly be due to reduction in the secretion of H+ from the parietal cells[15]. In that case, flavonoids in the extract might be responsible for H+ secretion. The same secondary metabolite is also thought to decrease histamine secretion, leading to decrease in H+ secretion as well. It also increases mucosal prostaglandin content which stimulate bicarbonate secretion to increase pH of the gastric content[16]. These results exhibit the capacity of the extract to increase the protection of the mucosa and to reduce its aggressive factors. The combination of those two activities contributes to its anti-gastric ulcer property, justifying its use as traditional medicine for stomachache.

V. CONCLUSION

These results suggest anti-gastric ulcer activity of the extract via prostaglandin synthesis which increases bicarbonate and mucous secretion to increase the mucosa protection and reduces gastric acidity. The protection could be the result of the flavonoids which increase prostaglandins synthesis or reduce acid secretion. The findings of this study confirmed that Perichlaenarichardii has anti-ulcer pharmacologic activity which might be due to flavonoids present in it. Therefore, this study validates the use of P. richardii as anti-ulcer medication in traditional medicine. Further investigations on isolation of specific phytochemicals and elucidating mechanisms of action are needed.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the Faculty of Sciences, University of Antananarivo, Madagascar, and the "Laboratoire de PharmacologieGénérale, de Pharmacocinétique et de Cosmétologie"(LPGPC) for providing the necessary facilities to enable us carry out the research project successfully.

REFERENCES

[1] A. Allen, G. Flemstrom, A. Garner, and E. Kivilaakso,Gastroduodenal mucosal protection,*American Physiological Society, 73(4)*, 1993, 823-830.

[2] A. Allen and G.Flemström, Gastroduodenal mucus bicarbonate barrier: protection against acid and pepsin,*American Journal of Physiology, 288(1*), 2005, C1-9.

[3] JD. Kaunitz andY.Akiba, Gastroduodenal mucosal defense: Role of endogenous mediators. *Current Opinion in Gastroenterology, 20*, 2004, 526-532.

[4] R. Gadekar, PK. Singour, PK. Chaurasiya, RS. Pawar andUK. Patil, A potential of some medicinal plants as an antiulcer agents,*Pharmacognosy Reviews, 4(8)*, 2010, 136.

[5] HHS.Fong, Tin-Win and NR. Farnsworth. Phytochemical Screening plants,*Pharmacological Reviews, University of Illinois, Chicago (USA),* 1977, 275-277.

[6] Office vétérinaire federal, Directives concernant les méthodesd'euthanasie pour les animauxd'expérience,*Directive Protection des animaux, 3.01*, 2020, 7-8.

[7] KH. Diehl, R. Hull, D. Morton, R.Pfister, Y.Rabemampianina, D. Smith, JM. Vidal and CV. De Vorstenbosch, A good practice guide to the administration of substances and removal of blood, including routes and volumes,*Journal of Applied Toxicology, 21(1)*, 2001, 15-23.

[8] J. Liu, J. Fang, J. Zhang, D. Wang, Z. Zhang, C. Wang, J. Sun, J. Chen, H. Li and S. Jing,Protective effect of anwulignan on gastric injury induced by indomethacin in mice, *Journal of Pharmacology and Experimental Therapeutics, 383 (1)*, 2022, 80-90.

[9] H. Shay, A simple method for the uniform production of gastric ulceration in the rat,*Gastroenterology, 5*, 1945, 43-61.

[10] G.Vinothapooshan andK. Sundar, Anti-ulcer activity of *Mimosa pudica* leaves against gastric ulcer in rats, Research Journal of Pharmaceutical, Biological and Chemical Sciences (RJPBCS), 1(4), 2010, 606-614.

[11] HK. Kinger and MK. Gupta, Evaluation of anti-ulcer activity of *Polygonumbarbatum* Linn. (whole plant), *Journal of Biomedical and Pharmaceutical Research, 1(2),* 2012, 34-37.

[12] JL. Wallace,Nonsteroidal anti-inflammatory drugs and the gastrointestinal tract, Mechanisms of protection and healing: current knowledge and future research,*American Journal of Medicine, 110(1A)*, 2001, 19S-23S.

[13] J.Alumets, M.Ekelund, R.Håkanson, J.Hedenbro, JF.Rehfeld, F.Sundler and S.Vallgren, Gastric acid response to pylorus ligation in rats: is gastrin or histamine involved,*Journal of Physiology, 323*, 1982, 145-156.

[14] AG.Naif,ME.Gehad, AMS.Sultan, ES.Amina,FA.Sultan,MA.Ziyad,MIME.Nesreen, ME. Mahmoud,SA.Maisaand Y.Mohammed, Preliminary study of gastroprotective effect of *Aloe perryi* and date palm extracts on pyloric ligation-induced gastric ulcer in experimental rats, *BioMed Research InternationalArticle, ID 9246785* https://doi.org/10.1155/2022/9246785, 2022.

[15] AS. Salim, The role of vagal adrenergic activity in the mechanism of gastric acid secretion after pylorus-ligation in the rat, *Journal of Pharmacy and Pharmacology, 41(8),* 1989, 566-568.

[16] MG. Repetto, SF.Llesuy Antioxidant properties of natural compounds used in popular medicine for gastric ulcers. *Brazilian Journal of Medical and Biological Research, 35(5)*, 2002, 523-534.