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Short Communication *Pharmacology*

Effects of the methanolic leaf extract of *Alchornea cordifolia* (Schum. & Thonn.) Muell. Arg. on different gastric ulcer models in rats

Telesphore B. NGUELEFACK, Pierre WATCHO*, Ngetla MANIYEH, Sylvie L. WANSI and Albert KAMANYI.

Animal Physiology and Phytopharmacology Laboratory, Faculty of Science, University of Dschang, P.O BOX 67 Dschang, Cameroon.
* Corresponding author, E-mail: pwatcho@yahoo.fr

ABSTRACT

The anti-ulcerogenic properties of the methanol extract of the leaves of *Alchornea cordifolia* (500 mg/kg b.w and 1000 mg/kg b.w) was investigated in rats using two methods: In the HCl/Ethanol technique, the plant extract (1000 mg/kg b.w) significantly ($p<0.01$) inhibited ulcer formation. The pylorus ligation model also resulted in a significant ($p<0.05$) inhibition of ulcer formation coupled with a decrease ($p<0.05$) in gastric juice secretion. Results of this study add more credibility in the ethnomedicinal use of the plant in the treatment of gastric ulcer.

Keywords: *Alchornea cordifolia*, gastric ulcer, inhibition, rat.

RESUME

Les propriétés anti-ulcérogéniques de l'extrait au méthanol des feuilles de *Alchornea cordifolia* (500 mg/kg p.c et 1000 mg/kg p.c) ont été évaluées chez le rat en utilisant les techniques de solution nécrosante (Mélange HCl/Ethanol) et de ligature pylorique. L'extrait au méthanol de *Alchornea cordifolia* (1000 mg/kg p.c) a inhibé de façon significative ($p<0.01$) la formation d'ulcères par la solution nécrosante (HCl/Ethanol). La technique de ligature du pylore a également entraîné une inhibition significative ($p<0.05$) des ulcères, associée à une baisse ($p<0.05$) de sécrétion du suc gastrique. Les résultats de cette étude justifient l'usage de cette plante en médecine traditionnelle contre les ulcères gastriques.

Mots clés: *Alchornea cordifolia*, ulcère gastrique, inhibition, rat.

INTRODUCTION

Alchornea cordifolia (Schum. & Thonn.) Muell. Arg. (Euphorbiaceae) is used in African ethnomedicine for the treatment of several diseases [1,2]. Cameroonian herbal practitionners suggest that *A. cordifolia* also known as "Christmas bush" possesses potent anti-ulcerogenic properties [3]. Flavonoids and tannins have been revealed in the leaves of *A. cordifolia* [4]. This study was therefore undertaken to verify the anti-ulcer activity of the leaf methanol extract of *Alchornea cordifolia* in rats using HCL/Ethanol and pylorus ligation induced-ulcer techniques.

MATERIALS AND METHODS

Animals

Adult male albino rats of Wistar strain, aged 12-15 weeks and weighing 105-268 g were used. They were fed on normal Laboratory diet and water given *ad libitum*, and starved for 48 h prior to the experiment.

Plant extract preparation

Fresh leaves of *A. cordifolia* were harvested in Dschang and the botanical identification performed by Dr Focho Derek of the Department of Plant Biology, Faculty of Science, University of Dschang, Cameroon. The plant specimen is deposited at the National Herbarium in Yaounde under the voucher number 9656/SRF/CAM. Leaves were air-dried and pulverised into fine powder. The powdered plant material (500 g) was extracted with 4 L of methanol for 72 h and the filtrate evaporated to dryness on a convection chamber to give an extraction yield of 30% (150 g of residue).

Experimental Procedure

HCl/Ethanol-induced gastric ulcers

Gastric mucosa lesions were induced in the rats following the methods of Hara and Okabe [5]. Rats were deprived of food for 48 h prior to the experiment but allowed free access to water. Five groups of five animals each were used. The first two groups of the rats were treated orally with the methanolic extract of *A. cordifolia* (500 mg/kg b.w and 1000 mg/kg b.w). The third group, positive control, received cimetidine (11.5 mg/kg b.w) as a standard drug for comparison whilst the fourth group serving as neutral control was administered with 2 mL of distilled water. After 90 mn of the treatment, each rat in group 1 to 4 received 1mL of HCl/Ethanol (150 mM/60%) necrotizing solution while the fifth group of rats received only the necrotizing solution and served as the negative control group. Following these treatments, the animals were sacrificed 1 h later by an overdose of ether. The stomachs were opened and the gastric damage observed. The length and width of each lesion was measured and the product taken as the

ulcer surface area; this was then scored as described by Tan *et al* [6], and the lesion index taken as the mean ulcer score. The percentage of ulcerated surface was determined as well as the percentage of inhibition [6].

Pylorus ligation-induced gastric lesions

In the above experiment, the dose of 1000 mg/kg b.w of the methanol extract produced best results and was therefore selected for this investigation in which the method of Shay et al [7] was used. Rats were orally treated with distilled water (10 mL/kg b.w, n=5), cimetidine (11.5 mg/kg b.w, n=4) or *A. cordifolia* (1000 mg/kg b.w, n=5) 1 h before pyloric ligation. 6 h after the ligation, ulcers formed in the gastric mucosa were measured and scored, and the ulcer index as well as the percentage of ulcerated surface and percentage of inhibition determined [6].

Measurement of gastric acidity

1 mL of the total centrifuged gastric contents from each pylorus-ligated rat was analysed for hydrogen ion concentration by titrating against NaOH (0.01 N).

Statistical analysis

Data are presented as mean ± SEM. Statistical analysis was performed using Student's "t" test and significance of difference was accepted at $p<0.05$.

RESULTS AND DISCUSSION

Results of this work are outlined in Tables 1 and 2, and highlight the prophylactic anti-ulcer properties of *A. cordifolia* leaf methanol extract in rats. The HCl/Ethanol method of inducing gastric lesions is generally considered as the better way of screening plant extracts for their anti-ulcer potency and cytoprotection is assessed in terms of absence or reduction in visible lesions [5]. Using this method, there was a significant ($p<0.05$) cytoprotective effect of *A. cordifolia* at both doses of 500 mg/kg b.w (82.22%) and 1000 mg/kg b.w (97.78 %) thus leading to a significant ($p<0.05$) reduction in ulcer index (Table 1). The plant extract may then stimulate endogenous factors such as prostaglandins for the promotion of mucus secretion, which together with bicarbonate, form an unstirred gel-like layer that protects the gastric mucosa against the corrosive agents [8,9,10].

In an attempt to assess the preventive and/or antisecretory effects of the methanol extract of *A. cordifolia*, the pylorus ligation technique was performed. *A. cordifolia* reduced the gastric secretion ($p<0.05$), ulcer index ($p<0.05$), ulcer surface ($p<0.05$) and gastric acidity (control: 140 7.01 mEq/L; *A. cordifolia* (1000 mg/kg b.w: 98 mEq/L) (Table 2). In pylorus-ligated rats, increased gastric acid levels have been associated with severe ulcerations of the mucosa [11]. The protective effects of the plant could then be achieved either through increased mucus production or through the reduction of the proteolytic activity of the pepsin in the gastric juice or by rendering the chemical composition of the mucus more defensive. Similar observations have also been reported elsewhere [12]. Phytochemical screenings have revealed the presence of flavonoids and tannins [2,4] in the leaves of *A. cordifolia* and which may account for the anti-ulcer property of the plant. Using both methods, cimetidine confirmed its anti-secretory and anti-histamine H_2 receptor activity even though its effect was less than the one of *A. cordifolia*.

It is concluded that the protective effect of *A. cordifolia* may be due to the biologically active compounds present in the leaves and thus justifying its popular use for the treatment of gastric ulcers.

Table 1 : Effects of the leaf methanol extract of *Alchornea cordifolia* on HCl/Ethanol– induced gastric lesions in rats

Treatment	Dose	n	Ulcer Index (Mean ± SEM) (mm²)	Ulcer surface area (Mean ± SEM) (mm²)	Ulcer Inhibition (%)	Ulcerated surface (%)
Distilled water (mL)	2	5	-	-	-	-
HCl/Ethanol (mL)	1	5	3.5 ± 0.42	180.00 ± 71.08	0	8.06
Cimetidine (mg/kg)	11.5	5	2.67 ± 0.19*	60.00 ± 5.35*	66.67	3.34
Alchornea cordifolia (mg/kg)	500	4	2.73 ± 0.19*	32.00 ± 4.45*	82.22	2.14
	1000	5	1.03 ± 0.57**	4.00 ± 1.35**	97.78	0.20

n : Number of rats used

*: Statistically significant relative to control ($P< 0.05$)

**: Statistically significant relative to control ($P< 0.01$)

Table 2: Effects of *Alchornea cordifolia* leaf methanol extract on pylorus ligated gastric lesions and gastric secretions in rats

Treatment	Dose	n	Ulcer Index (Mean ± SEM) (mm^2)	Ulcer surface area (Mean ± SEM) (mm^2)	Ulcer Inhibition (%)	Ulcerated surface (%)	Gastric pH	Gastric juice (mL)	Gastric acidity (mEq/L)
Distilled water (mL)	2	5	2.72±0.21	12.00±3.05	0	1.02	1.00±0.03	8.65±1.41	104±7.01
Cimetidine (mg/kg)	11.5	4	2.29±0.12*	9.00±3.42	25.00	0.66	1.01±0.05	6.20±0.77*	98.00±12.68
Alchornea cordifolia (mg/kg)	1000	5	1.77±0.68*	6.00±2.81*	50.00	0.44	1.02±0.03	5.05±0.36*	98.40±6.28

n: Number of rats used

*: Statistically significant relative to control ($P<0.05$)

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