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# ANTI-ULCER ACTIVITY OF AQUEOUS LEAF EXTRACT OF *PERSEA AMERICANA* (FAMILY-LAURACEAE)

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**Abstract**
The study was carried out to investigate the anti-ulcer activity of aqueous leaf extract of *Persea americana.* Groups of albino rats were pre-treated orally with aqueous leaf extract of the plant before administration of the ulcerogenic drugs-indomethacin and ethanol. The animals were sacrificed by a blow on the head, their stomachs removed and examined for ulcers. The extract produced significant ($P<0.05$), and dose-dependent anti-ulcer activity against indomethacin- and ethanol-induced ulcers in rats. Phytochemical studies revealed the presence of alkaloids flavonoids, saponins and tannins. These results suggest that the extract possesses significant anti-ulcer activity against experimentally induced gastric lesions and may justify its use in traditional medicine.

*Keywords*: Anti-ulcer activity; *Persea americana*; Rats

## INTRODUCTION

*Persea americana* Mill, (Family-Lauraceae) is one of the 150 species of the avocado pear[1]. They are widely cultivated throughout the tropics and subtropics of the world for their edible fruits and for some economic and therapeutic uses[2]. The plant commonly known as avocado pear has indigenous names as: Ube Oyibo (Igbo); Pia (Yoruba) and Eben Mbakara (Efik). The leaf of *Persea americana* is used in Guinea for the treatment of jaundice[3], and in most of the West African countries, it is used as a diuretic, anti-diarrhea, astringent and antidysentric[4]. It is reported that the aqueous leaf extract is taken orally in the form of a conventional tea decoction with no report of toxic effects[5]. This study was carried out to investigate the widespread claim by many herbalists in the South Eastern part of Nigeria as regards the use of an aqueous leaf extract of the plant for the treatment of internal ulcer.

## MATERIALS AND METHODS

### *Collection and preparation of plant extract*

The leaves of *Persea americana* were collected in Nsukka, Enugu State, Nigeria, identified and authenticated by Mr. A. Ozioko of the Botany Department, University of Nigeria, Nsukka. A voucher specimen has been deposited in the herbarium of the Department of Pharmacognosy, Faculty of Pharmaceutical Sciences of the same University. The leaves were shade-dried land

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pulverized to coarse powder. To 200g of the powdered leaves in a container with lid, 1 litre of boiling water was added and covered. It was allowed to stand for 24 hours with intermittent shaking. The mixture was then filtered with No. 1 Whatman qualitative filter paper. The extract was stored in a refrigerator for future use throughout the study.

***Animals***

Inbred male albino rats (180 – 250 g) obtained from Faculty of Biological Sciences animal house, University of Nigeria Nsukka were used for the experiments. They were kept in standard environmental conditions and fed with standard diet, with water *ad libitum.* Food was withdrawn 24 hours and water one hour before drug treatment.[6]

***Anti-ulcer activity***

Two models (Indomethacin and ethanol) for inducing acute experimental ulcer lesions in laboratory animals were used to evaluate the anti-ulcer activity of the extract. Twenty rats were used for each model and they were divided randomly into five groups of 4 each and coded to prevent observer bias. Groups 1 and 2 had 4 animals each and served as negative and positive control as they received 5 ml/kg saline and cimetidine (100mg/kg) respectively. Groups 3, 4 and 5 also had 4 animals each and received the extract at doses of 100, 200 and 400 mg/kg respectively. All the drugs were administered orally to all the rats.

***Indomethacin-induced ulcers***

Animals in groups 1 and 2 were given saline and cimetidine respectively, while those in groups 3, 4 and 5 were pretreated with 100 mg/kg, 200 mg/kg and 400 mg/kg of the extract. After one hour, indomethacin 30 mg/kg was administered to all the rats. Seven hours later, the rats were killed by a blow on the head. The stomachs were removed and each opened along the greater curvature. After fixing the tissue by immersing in 10% formalin, it was rinsed under a stream of water and examined for ulcers. The ulcers were counted by the aid of a hand lens (X10 magnification) and given severity rating as follows: less than 1 mm = 1, 1-2 = 2, and greater than 2 mm = 3. The overall total was divided by a factor of 10 to derive the ulcer index for each animal.[7]

***Ethanol-induced ulcer***

Saline and cimetidine were administered to animals in groups 1 and 2 and the extract in doses described above administered to those in groups 3, 4 and 5 respectively. After one hour, absolute ethanol 1 ml/kg was administered to all the rats. The rats were sacrificed after one hour and examined for ulcers as described before.

***Phytochemical Screening***

The aqueous leaf extract was tested for the presence or absence of alkaloids, flavonoids, glycosides, saponins, tannins and fats and oils using standard phytochemical procedures and tests.[8]

***Statistical analysis***

The result are shown as the mean ulcer index $\pm$ standard error of the mean. The significance of the data was calculated at the 95% confidence interval using the student's t-test.

## RESULTS AND DISCUSSION:

**Anti-ulcer activity**

Indomethacin induced ulcers (Table 1). As shown in the table, indomethacin induced ulcers in 100% of the animals in the negative control (Saline 5 ml/kg) group. The ulcer index was 2.20 $\pm$ 0.11. Pre-treatment with cimetidine and the extract significantly ($P< 0.05$) reduced the severity of indomethacin-induced ulcers. The protective effects of the extract as shown in Table 1 were dose-dependent.

Ethanol-induced ulcers (Table 2). Ethanol induced ulcers in all the animals in the negative control group, the ulcer index being 4.85 $\pm$ 0.17. Although all the four animals that were pre-treated with the extract at 100 mg/kg had ulcers, the ulcer index was significantly

reduced from 4.85 ± 0.17 to 1.30 ± 0.13. The protective effect of the extract was also dose-dependent. Pre-treatment with cimetidine also significantly reduced the ulcer index to 0.25 ± 0.10.

**Table 1:** Effects of *P. americana* aqueous leaf extract on indomethacin-induced ulcers in rats

| Group | Treatment | Quantal ulcer incidence | Mean ulcer index ± SEM | Percentage protection (%) |
|---|---|---|---|---|
| 1 | Saline (5 ml/kg) | 4/4 | 2.20 ± 0.11 | 0.00 |
| 2 | Cimetidine (100 mg/kg) | ¼ | 0.20 ± 0.20* | 90.91 |
| 3 | Extract 100 mg/kg | ¾ | 0.25 ± 0.10* | 88.64 |
| 4 | Extract 200 mg/kg | 2/4 | 0.10 ± 0.02* | 95.45 |
| 5 | Extract 400 mg/kg | 0/4 | - | 100.00 |

* Significant

Percentage protection to ulcer formation in rats by the extract was calculated as follows:

$$\left\{1-\left[\frac{Mean\ Ulcer\ index\ with\ extract}{Mean\ Ulcer\ index\ with\ saline\ (5ml/kg)}\right]\right\}\times 100$$

**Table 2:** Effects of *P. americana* aqueous leaf extract on ethanol-induced ulcers in rats

| Group | Treatment | Quantal ulcer incidence | Mean ulcer index ± SEM | Percentage protection (%) |
|---|---|---|---|---|
| 1 | Saline (5 ml/kg) | 4/4 | 4.85 ± 0.17 | 0.00 |
| 2 | Cimetidine (100 mg/kg) | ¾ | 0.25 ± 0.10* | 94.85 |
| 3 | Extract 100 mg/kg | 4/4 | 1.30 ± 0.13* | 73.20 |
| 4 | Extract 200 mg/kg | ¾ | 0.70 ± 0.25* | 85.57 |
| 5 | Extract 400 mg/kg | 2/4 | 0.20 ± 0.12* | 95.88 |

* Significant

Percentage protection to ulcer formation in rats by the extract was calculated as follows:

$$\left\{1-\left[\frac{Mean\ Ulcer\ index\ with\ extract}{Mean\ Ulcer\ index\ with\ saline\ (5ml/kg)}\right]\right\}\times 100$$

***Phytochemical Screening***

The results of the phytochemical screening indicate that the extract contains alkaloids, flavonoids, saponins and tannins.

## RESULTS AND DISCUSSION

The results of this study show that the aqueous leaf extract of *P. americana* reduced significantly indomethacin, and ethanol – induced ulcers in rats when administered orally (Tables 1 and 2). The effect of the extract was more pronounced in indomethacin than in ethanol-induced ulcers. The protective effects of the extract were dose-dependent and at a dose of 400 mg/kg there was 100% protection from indomethacin-induced ulcers. At the same dose, the protective effect from ethanol-induced ulcers was 95.88%. Although 50% of the animals in this group had ulcers, the reduction in the severity was significant when compared to the negative control (saline) group. The mean ulcer index was reduced from 4.85 ± 0.17 to 0.20 ± 0.12. The effect of the extract compare favourably to cimetidine 100 mg/kg (positive control), an effective $H_2$-receptor antagonist.

The mechanism by which the aqueous leaf extract of *P. americana* produced its gastro-protective effects in rats is not clear. However pharmacological screening on isolated tissue preparations is in progress to elucidate the possible mechanisms of action. The report by Owolabi et al[5] that the aqueous

extract of this plant produced a concentration dependent inhibition of the contractions induced by histamine and acetylcholine on isolated smooth muscle preparations may suggest a reversal of the pathogenetic mechanisms of peptic ulcer pathway.[6] The ability of the extract to protect the rats from experimentally induced ulcers might be related to either its observed anticholinergic and / or antihistaminic activity.

It has been established that indomethacin is an ulcerogenic agent especially when administered on an empty stomach.[9] The ulcerogenic activity of indomethacin and other non-steroidal anti-inflammatory agents as postulated might be due to their ability to inhibit prostaglandin synthesis.[10] Several lines of evidence suggest that prostaglandins inhibit gastric secretion and are important to normal gastric physiology and mucosal intergrity.[11,12,13] Some of the mechanisms suggested for their effect include tightening of the gastric mucosal barrier[14] and stimulaltion of the gastric sodium pump.[15] The protective effects of the extract on indomethacin-induced ulcers in rats might be related to any of the mechanisms suggested.

Phytochemical screening of the extract revealed the presence of saponins and tannins. Some saponins and their triterpenoid derivatives have been found effective in ulcer healing by forming protective mucus materials on the gastric mucosal.[16] Also, tannins have been shown to precipitate micro-proteins at the site of ulcers thereby forming an impervious protective pellicle over the lining to prevent adsorption of toxic substance thereby preventing the attack of proteolytic enzyme.[17] Since the extract contained mainly saponins and tannins, these constituents might have been responsible for the observed effects.

## CONCLUSION

The results of this study show that the aqueous leaf extract of *P. americana* is effective against experimentally induced gastric lesions in rats as studied with indomethacin and ethanol. The gastroprotective effect is more pronounced against indomethacin, than ethanol-induced ulcers and is dose-dependent. The extract appears to be potentially useful in the treatment of gastric disorders including ulcers. This may justify its widespread use and confirm the medicinal benefits claimed by herbalists in the South Eastern part of Nigeria. The exact mechanism of action by which the extract protects laboratory animals from experimentally induced ulcers as studied with indomethacin and ethanol has not been elucidated. The major phytochemical constituents appeared to be saponins and tannins and might have been responsible for the observed effects.

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