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# Anti-ulcer activity of *Plumbago Zeylanica* linn root extract

**Kakjing Dadul Falang*, Mary Ogonnaya Uguru, Noel Nenman Wannang, Iliya Hosea Azi, Nwoye Chiamaka**

*Department of Pharmacology, Faculty of Pharmaceutical Sciences, University of Jos, Nigeria*

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**ABSTRACT**

*Many medicinal plants used in ethnomedicine have been reported to possess anti-ulcer activity. One of such plants is Plumbago zeylanica Linn. Our objective is to evaluate the anti-ulcer activity of the aqueous extract of the roots of Plumbago zeylanica Linn on aspirin and indomethacin-induced acute gastric ulceration in albino Wistar rats. The anti-ulcer activity of the aqueous root extract was assessed by determining and comparing the ulcer score, ulcer index and percentage protection of the extract with that of the negative and positive control groups. Omeprazole was used as standard drug. The extract at doses of 25, 50 and 100 mg/kg respectively produced statistically significant ($P<0.05$) dose-dependent inhibition of aspirin induced gastric mucosal damage. In the indomethacin-induced ulcer, it was only at doses of 50 and 100 mg/kg respectively that the extract exhibited significant ($p< 0.05$) dose – dependent inhibition of the gastric mucosal damage. Oral acute toxicity testing showed oral $LD_{50}$ to be greater than 5000 mg/kg, indicative of the wide margin of safety of the root extract. The findings indicated that the aqueous extract of the roots of Plumbago zeylanica Linn possesses anti-ulcer activity.*

**Keywords:** *Plumbago zeylanica*, Gastric ulceration, Indomethacin, Rats

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## INTRODUCTION

From time immemorial, medicinal plants have been used for the treatment of many debilitating health ailments of man. These are often used as herbal remedies which could be herbs or herbal materials, herbal preparations and finished herbal products containing as active ingredients plants parts, plant materials or their combinations in various proportions [1]. They are mostly used as herbal teas, decoctions or extracts with easily accessible and affordable liquids like water, alcohol, honey or milk. The use of medicinal plants is so wide spread across the world that the World health Organization estimates 80% of the population of the world engages in the use of herbal medicines [1].

In Nigeria, as indeed in other parts of the world, the use of herbs and herbal remedies forms a significant instrument of health care delivery. One of such herbs which has been reported for its ethnomedicinal use in Nigeria is *Plumbago zeylanica* Linn a weed widely distributed in the tropical and subtropical areas of the world [1]. It is known in English as Leadworth or Ceylon Leadworth. Belonging to the family Plumbaginaceae, it is a branched evergreen shrub reaching about two to three metres in height and reportedly found in Nigeria where in the south western part of the country, it is known as *inabiri* among the Yorubas [2]. The most frequently used part of

*Plumbago zeylanica* Linn are the roots which have been traditionally reported to be used for a variety of ailments such as dyspepsia, piles, diarrhoea, skin diseases and rheumatism [1]. The roots have also been reported to possess antibacterial, antifungal and abortifacient properties [2], analgesic and anti inflammatory [1] as well as antispasmodial activity [1]. In addition the plant has anti-cancer, hepatoprotective, anti-diabetic, anti-fertility, and immunosuppressive properties [3].

Various reports [1,3,4,6] have it that the phytochemical constituents present in the plant include tannins, alkaloids, phenols, reducing sugars, flavonoids, saponins, glycosides and steroids.

The aim of this investigation is to assess the anti-ulcer property of the aqueous extract of the roots of *Plumbago zeylanica* Linn on aspirin and indomethacin-induced gastric ulcers in rats and to possibly understand its mechanism of action and the basis for its ethnomedicinal use in the treatment of dyspesia.

## MATERIALS AND METHODS

### Collection of Plant material and preparation of extract

The root of *Plumbago zeylanica* Linn was collected from Jos garden, old zoo, Jos, Plateau State, Nigeria and identified by Professor F.C Ohiri of the Department of Pharmacognosy, Faculty of Pharmaceutical Sciences University of Jos. The roots were washed, cut into small pieces and left to air dry at room temperature and reduced to a coarse powder with mortar and pestle. The coarse powder was subjected to continuous aqueous extraction in a soxhlet extractor for 24hours and then evaporated at a temperature of 45$^{\circ}$C to get a dark green semi solid mass of a yield of 10.15%.

### Animals

Albino rats (Wistar strain) of both sexes weighing between 150g – 270g raised at the Animal House Unit, University of Jos, Plateau State Nigeria were used for the study. The animals were maintained under standard environmental conditions of temperature and humidity and allowed access to food and water *ad libitum*. Experiments on the animals were performed strictly in accordance with standard guidelines and The Institutional Animal Ethics Committee approved all procedures. All the drugs and extract were administered orally throughout the study with the use of an oral cannula.

### Acute toxicity

Acute toxicity was ascertained according to the method of Lorke [1]. The animals were observed for 48 hours for effect of toxicity and the number dead in each group within the period was noted.

### Anti-Ulcer activity

### Indomethacin-induced ulcer

Twenty – five albino Wistar rats, fasted for 18 hours were weighed and randomized into five groups of five rats each. Groups one (negative control) and two (positive control) rats were given pretreatment of 2 ml/kg distilled water and omeprazole 20 mg/kg respectively. Rats in groups three, four and five were pretreated with aqueous root extract of *Plumbago zeylanica* Linn at doses of 25, 50 and 100 mg/kg respectively. After 30minutes, indomethacin 40 mg/kg was administered to each rat. Eight hours after indomethacin administration, the rats were sacrificed [1,2] under chloroform anaesthesia. The stomachs were removed, opened along the greater curvature and rinsed with clean water. They were then examined macroscopically with a hand lens. The ulcer lesions observed were scored according to severity [3,4] as follows:

0 = No ulcer
1 = Haemorrhagic and slightly dispersed ulcers
2 = 1 ulcer, haemorrhagic and up to 5mm length
3 = more than 1 ulcer, each up to 5mm length
4 = 1 ulcer above 5mm in length
5 = more than 1 ulcer above 5mm in length.

The mean ulcer score was calculated by dividing the sum of the ulcer scores by the number of animals in the group. This was divided by 10 (the magnification of the hand lens used for proper macroscopic view) and expressed as the Mean Ulcer Index [1]. The percentage protection was calculated according to the formula below [2,3]:

$$\text{Percentage protection} = \frac{\text{MUI of control} - \text{MUI of treated}}{\text{MUI of control}} \times 100\%$$

Where: MUI = Mean Ulcer Index.

**Aspirin-induced ulcer**

Twenty - five albino Wistar rats, fasted for 18 hours were weighed and randomized into five groups of five rats each. Rats in groups one and two received distilled water 2 ml/kg and omeprazole 20 mg/kg respectively. Rats in groups three, four and five received 25, 50 and 100mg/kg of aqueous extract of *Plumbago zeylanica* Linn root respectively. After one hour, aspirin 200 mg/kg was administered to each rat and was sacrificed 4 hours later under chloroform anesthesia [4]. The stomachs were removed, opened along the greater curvature, rinsed and macroscopically examined with the aid of a hand lens. The lesions observed were scored according to severity [13, 14] as in indomethacin-induced ulcer and same calculations were done.

**Statistical Analysis**

The values were analyzed as mean $\pm$ SEM using one way ANOVA and $P<0.05$ was considered statistically significant.

## RESULTS

Acute Toxicity results showed that the $LD_{50}$ was greater than 5000 mg/kg.

The effect of *Plumbago zeylanica* Linn on aspirin and indomethacin induced ulcer are presented in Table 1 and table 2.

**Table 1: Effect of aqueous root extract of *Plumbago zeylanica* Linn on indomethacin-induced ulcer in albino Wistar rats**

| Treatment | Mean Ulcer score | Mean Ulcer Index | Percentage protection (%) |
|---|---|---|---|
| Distilled water | 2.20±0.80 | 0.22±0.08 | 0 |
| Omeprazole 20 mg/kg | 0.80±0.58 | 0.08±0.06 | 63.6 |
| Extract 25 mg/kg | 0.80±0.58 | 0.08±0.06 | 63.6 |
| Extract 50 mg/kg | 0.40±0.25* | 0.04±0.03* | 81.8 |
| Extract 100 mg/kg | 0.00±0.00* | 0.00±0.00* | 100 |

*Values are represented as Mean ±Standard Error of Mean*
*n = Number of Animals = 5*
** P < 0.05 indicates significant when compared to the negative control*

**Table 2: Effect of aqueous root extract of *Plumbago zeylanica* Linn on aspirin-induced ulcer in albino Wistar rats**

| Treatment | Mean Ulcer Score | Mean Ulcer Index | Percentage protection (%) |
|---|---|---|---|
| Distilled water | 2.00±0.78 | 0.20±0.08 | 0 |
| Omeprazole 20 mg/kg | 0.40±0.40* | 0.04±0.04* | 80 |
| Extract 25 mg/kg | 0.60±0.40* | 0.06±0.04* | 70 |
| Extract 50 mg/kg | 0.40±0.04* | 0.40±0.04* | 80 |
| Extract 100 mg/kg | 0.00±0.00* | 0.00±0.00* | 100 |

*Values are represented as Mean ±Standard Error of Mean*
*n = Number of Animals = 5*
**p <0.05 indicates significant difference in comparison with negative control*

## DISCUSSION

The etiology and pathogenesis of ulcers in the most part remains unknown and even controversial [12,4]. But it is quite well known that ulcers in the gastrointestinal tract, which could be gastric or duodenal, come about because of injury to the gastrointestinal walls. The injury could arise as a result of many factors. It is believed that the

pathogenesis depends mainly on the interplay of two main factors. These include aggressive factors such as acid, bicarbonate, pepsin and defensive mechanisms involving the mucosal barrier, mucus and mucus turn over as well as blood supply [5]. There is also a third factor which is infection with the bacteria *Helicobacter pylori*, long identified as a principal cause of peptic ulcers [6]. Thus, for there not to be ulcers, a delicate balance must be maintained between these factors. There have been many approaches to the maintenance of this balance. Some of these have involved non specific approaches such as regular food intake, proper and adequate rest and the avoidance of ulcer causing agents. In addition, there is a battery of anti ulcer drugs that have been deployed. In the main, these have been used to inhibit the secretion of gastric acid or improve the mucosal defense mechanisms through increase in mucus production, surface epithelial cells stabilization or interfering with the prostaglandin synthesis [18].
But successes with these drugs have often been cut short as a result of various side effects. Hence, the search light is being turned on herbal products given the importance of plants as an excellent source of anti-ulcer remedies as highlighted in literature sources [7]. It is in this regard that this investigation focuses on the antiulcer effect of *Plumbago zeylanica* Linn.

The results as shown in both Table 1 and Table 2 indicated that the aqueous root extract of the roots of *Plumbago zeylanica* Linn offers similar percentage protection against both aspirin and indomethacin-induced ulcers in comparison to omeprazole a known anti-ulcer drug. Omeprazole which is a proton pump inhibitor (PPI) fairly protected the gastric mucosa but the extract at 50 mg/kg and 100mg/kg respectively in both the aspirin and indomethacin induced ulcers showed more percentage protection. These results indicate that the effect of the extract at 50 mg/kg and 100 mg/kg was almost similar to that of omeprazole suggesting a possible inter-relationship in the way they act. As has been reported [8], PPIs can produce an almost complete suppression of acid secretion with the acid secretion being reduced no matter the source of secretory stimulation.

Non-steroidal anti-inflammatory drugs (NSAIDs) such as aspirin and indomethacin cause gastric ulceration by inhibiting biosynthesis of 'cytoprotective prostaglandins' (through blockade of cyclo-oxygenase pathway of arachidonic acid metabolism) leading to overproduction of leukotrienes and other products of 5-lipoxygenase pathway. Therefore the protective action of *Plumbago zeylanica* Linn against aspirin and indomethacin - induced gastric lesions could possibly be due to its 5-lipoxygenase inhibitory effect [12, 15].

Furthermore, the protective effect of the extract could be attributed to the phytochemical constituents indentified in many reports earlier mentioned. Tannins which are reportedly present in the roots of *Plumbago zeylanica* Linn have an astringent action. This might explain the antimicrobial effect and could be contributory to the antiulcer activity [20]. Because of the reported antimicrobial (antibacterial) effects, it could have been helpful and useful to find out the effect of the extract on the bacterium *Helicobacter pylori*, a causative agent of peptic ulcers. It is also reported that some tannins suppress gastric secretion and thus have the local effect of protecting the gastric mucosa [24] and this may partly explain the anti-ulcer effect of the extract.

Flavonoids are also reportedly present in the roots of *Plumbago zeylanica* Linn. They have anti-oxidant properties and in addition strengthen the mucosal defense system by stimulating gastric mucus secretion [25]. By strengthening the mucosal defense, they thus have significant anti-ulcer property as has been reported [26, 27]. This could explain the anti-ulcer effect of the extract. Antioxidant activity has been reported in extracts that contain flavoinoids [24] and this is important because oxidative damage is a common factor in the pathogenesis of ulcer by different experimental and clinical models. Antioxidants are capable of preventing the lesion formation caused by various ulcer causing agents. Since *Plumbago zeylanica* Linn root extract contains flavonoids and possess strong antioxidant properties [3], these may play a role in reducing gastric mucosal injuries in experimental animals as has been found in this study.

In conclusion, the results established the anti – ulcer activity of the aqueous extract of the roots of *Plumbago zeylanica* Linn against indomethacin and aspirin – induced ulcer in albino Wistar rats and provides a basis for its ethnomedicinal use in the treatment of dyspepsia.

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