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*Original article*

# Anti-Ulcerogenic and Toxicological Evaluation of Polyphenol Rich Extract of *Cochlospermum Planchonii* Roots in Tissues of Aspirin-Induced Ulcerogenic Rats

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**ABSTRACT**

*The folkloric use of Cochlospermum planchonii roots as an anti-ulcerogenic and its safety is yet to be affirmed with scientific confirmation and this study is designed to do that. This study evaluated the anti-ulcerogenic activity and safety of polyphenol rich extract of Cochlospermum planchonii (PRECPR) roots in aspirin-induced ulcerogenic rats. These roots were processed to give dosages of 50, 100 and 150 mg/kg bodyweight. Thirty rats (138.0 ± 5.0 g) were assigned into six groups. Rats in group A (control) received 1.0 ml of distilled water. Those in groups B – F were administered 200 mg/kg body weight of aspirin and then treated with 1.0 ml of distilled water, 1.0 ml equivalent to 0.05 mg/kg body weight of omeprazole, 50, 100 and 150 mg/kg body weight of PRECPR, respectively. PRECPR dose-dependently increased ($p > 0.05$) nitric oxide, pH, activities of enzymes, concentrations of bilirubin, creatinine, haematological indices and decreased pepsinogen, volume and acidity of the gastric juice significantly. These results compared favourably ($p < 0.05$) with those of omeprazole treated group. This study provided strong indication that this extract could serve as an anti-ulcerogenic agent that is safe.*

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## INTRODUCTION

Ulcer is an eroded area of the skin or a mucous membrane, marked by tissue disintegration [1, 2]. Gastrointestinal tract ulcer occurs in the lining mucosa of the gastrointestinal tract and can be in the stomach, duodenum, oesophagus or Merkel's diverticulum depending on the site of the ulceration [1]. It is as a result of a variance between mucosal defensive factors such as bicarbonate, prostaglandin, nitric oxide, growth factors and injurious factors like acid, pepsin [3]. The risk factors identified for ulcerogenesis comprises of excess intake of alcohol, bacterial infection, stress, use of steroidal and non-steroidal anti-inflammatory medication, and trauma [4, 5]. Sustainable efforts and constant research in this area lead to the development of several drugs that can act at multi steps during ulcer pathogenicity such as proton pump blockers, histamine receptor blockers and *H. pylori* inhibitors, nevertheless, majority of them have been documented with the pose of adverse effects [6]. Hence natural compounds from plants are being explored to produce more effective, saver and inexpensive drug for the management of ulcer, even though the potential of most of these antiulcer plants especially in developing countries are still largely unexplored [7].

*Cochlospermum planchonii* plant (Cochlospermaceae) is a familiar West African species used in orthodox medicine, it has a wide range of applications in different parts of African, it is commonly known as "false cotton" in English and

"Faux cotonnier" in French. In Ivory Coast for instance, the root is used to treat schiotomiasis, jaundice, fever and back pains [7]. While in Burkina Faso, the rhizomes and leaves are separately used locally in the treatment of jaundice, malaria, diabetes and diarrhoea [8]. A study by [9] shows significant trypanocidal properties with petroleum stem bark extract of *Cochlospermum planchonii*. Phenolic compounds are secondary metabolite in plants and are known to possess various medicinal properties like antimicrobial, antifungal, antiulcer and the different molecular frameworks of this compound is attributed to their properties of protection against oxidative damage [10, 11]. Nafiu *et al.* (2011) reported an appreciable amount of phenolics in the roots of *Cochlospermum planchonii* which has not been evaluated for antiulcer activity. In addition, a recent study by Nafiu *et al.* (2020) on phenolic contents of the plant revealed 47.7 mg/gallic acid equivalent and 49.14 mg/quercetin equivalent. Therefore, the present study was aimed at evaluating the anti-ulcerogenic potential of polyphenol-rich extract of *Cochlospermum planchonii* roots and its cytoprotective properties in some tissues of aspirin-induced peptic ulcerogenic rats.

## MATERIALS AND METHODS

### *Plant collection*

*Cochlospermum planchonii* plant was obtained from the herb seller at *Zango* market, Ilorin Nigeria. Identification and authentication were carried out in the Herbarium Unit of the Department of Plant Biology, University of Ilorin, Ilorin, Nigeria were a voucher specimen (UIH1064) was deposited.

### *Preparation of polyphenolic extract*

Roots were washed with distilled water and then air dried in the laboratory at room temperature (25°C). After which were pulverized to powder using an electric blender (Philip Comfort Blender, model HR1727, Holland). 200g of *C. planchonii* powder were soaked with 1L of n-hexane to remove lipophilic non-polyphenolic compounds and all other lipid soluble substances. The extract obtained was air dried and sequentially macerated in cold refrigerated 80% aqueous methanol and aqueous acetone for 18hours intermittent shaking to extract low and high molecular weight polyphenols respectively. Both extracts were combined and filtered using a cotton plug and later with Whatman No. 1 filter paper and concentrated at 40°C under reduced pressure to give a yield of 12.25%. A calculated amount of the residue was weighed and reconstituted in distilled water to give the required dosage of 50, 100, 150mg/kg body weight used in this study [13].

### *Animals*

Thirty Wistar rats (*Rattus novergicus*) of average weight 138.0 ± 5.0 g were obtained from Ebenezer Animal Farm in Ogbomosho, Oyo State, Nigeria. The animals were kept in neat and well-ventilated cages with easy access to standard rat chow and clean tap water before the commencement of the experiment.

### *Experimental design*

Thirty healthy Albino rats with an average weight of 138± 5.0 g were randomly divided into six groups of five rats each after a week of acclimatization. They were fasted for 12 hours before ulceration was induced once daily for 3 consecutive days with Aspirin (200mg/kg bodyweight) in-line with the procedure described by [14]. The animals were then grouped as follows: Group A (Normal control) without ulceration were administered 1ml of distilled water; Group B was administered with distilled water; Group C were administered 0.05 mg/kg bodyweight Omeprazole; and Group D, E and F were administered 50, 100 and 150 mg/kg body weight of polyphenolic –rich extract of *Cochlospermum planchonii* root respectively for 14 days.

### *Preparation of serum and tissues*

All rats were sacrificed 24 hours after the last treatment. The animals were individually weighed and anaesthetized in a jar containing cotton wool soaked with diethyl ether. The neck region was quickly cleared of fur to expose the jugular vein. The veins were cut sharply with sterile surgical blade and the rats were allowed to bleed into clean EDTA and plain bottle.

To obtain the serum, the blood in the plain bottles were centrifuged at 3000×g for 10minutes, then the clear supernatant (serum) was aspirated using Pasteur pipette into clean, dry sample bottles and were refrigerated until required for necessary assays. Thereafter, the rats were quickly dissected; the stomach of each rat was ligated at both openings (at the lower esophageal sphincter and pyloric sphincter) and injected with 3 ml of distilled water to collect the gastric juice [1]. Determinations of ulcer indices in the stomach were done prior to the preparation of tissue homogenates.

***Determination of ulcer biomarkers***

***Pepsinogen concentration***

The method described by [15] was used to assay for the concentration of pepsinogen in the animal's serum. About 150 µl of serum was pipetted into a test tube; a pinch of activated charcoal was then added and allowed to stand for 15 minutes thereafter centrifuged for 20 minutes to remove charcoal from the treated serum. The treated serum (25µl) was pipetted in two test tubes, to the first tube, 125µl of hemoglobin and 250µl of 5% TCA was added and centrifuged after which the absorbance was read at 280 nm. The second tube was incubated for 24 hrs and 250 µl of 5% TCA was added and centrifuged. The supernatant was picked and its absorbance was read at 280 nm.

$$\text{Concentration of Pepsinogen} = \frac{\triangle \text{Absorbance of Sample}}{\triangle \text{Absorbance of Standard}} \times \text{concentration of standard [15]}$$

**Nitric Oxide Concentration**

The method described by [16] was used to assay for the concentration of nitric oxide in the serum of animals. Briefly, 2.0 ml of sodium nitroprusside, 0.5 ml of PBS (Phosphate Buffer Saline) together with 0.5 ml of the serum were pipetted into a test tube and incubated for 30 minutes at 25°C, thereafter 0.5 ml of Griess reagent was added to the mixture and incubated for another 30 minutes and the absorbance read at 546 nm.

$$\text{Concentration of nitric oxide} = \frac{\triangle \text{Absorbance of Sample}}{\triangle \text{Absorbance of Standard}} \times 100$$

**Determination of the volume and pH of the gastric juice**

The gastric juice collected was centrifuged at 850 x *g* for 10 minutes. The volume of the supernatant was measured using a graduated measuring cylinder and taken as the volume of the gastric juice [1]. The pH of this supernatant was then determined using digital pH meter.

***Acidity of the gastric juice***

The procedure described by [17] was used for determining the acidity of the gastric juice. This was elucidated by titrating 0.5 ml of gastric juice against 0.01N of NaOH (0.1N/10 NaOH) using phenolphthalein as indicator and expressed in terms of the amount (ml) required to titrate 100 ml of gastric secretion.

$$\text{Acidity} = \frac{\text{Volume of NaOH x 0.01N x 100}}{\text{Volume of gastric juice}}$$

***Determination of biochemical and hematological indices***

The activities and concentrations of enzymes and biomarkers were determined by the following procedures: alkaline phosphatase, aspartate aminotransferase and alanine aminotransferase [18]. While the hematological parameters were determined using Automated Haematological Analyser, Sysmex, KX- 21 (Japan).

***Antioxidant properties of the plant extract***

The antioxidant properties of the crude extract were determined in-line with the procedure as stated by [19, 20] to evaluate the superoxide activity dismutase and that of Catalase was in accordance to the method of [Beers and Sizer, 1952] while Reduced glutathione [22], bilirubin [23] and creatinine [24] were evaluated with different procedures as stated respectively.

***Statistical analysis***

All data were expressed as the means of five determinations ± Standard Error of Mean (SEM). Statistical evaluation of data was performed by SPSS version 20 using one way Analysis of Variance (ANOVA) and Duncan Multiple Range Test (DMRT). The data were considered statistically significant at $p < 0.05$.

## RESULTS

***Effect of extract on gastric juice secretion, acidity and pH***

Result from the administration of Aspirin to induced ulcer in the experimental animals shows an increase in the volume of the gastric juice (ml) for the Ulcer untreated group while there was no significant different at 0.05 between group administer the standard drug (0.05 Omeprazole) and the extract treated groups (Figure 1).

Also, there was increase in pH value of the gastric juice of the extract treated groups and the standard drugs when compared to the ulcer untreated group as indicated in Figure 1.0. There was no significant difference at 0.05 of the gastric juice acidity of the group administer with the standard drug with that of the extract treated groups (Figure 1)

***Effect of extract on pepsin activity***

Serum Pepsinogen concentration was lower after treatment with 0.05 Omeprazole and the extract treatment groups (50, 100 and 150mg/kgbw) when compared before treatment after inducing ulceration (Figure 2). Whereas Nitric oxide concentration increased after treatment with the standard drug and the extract treated groups when compared with the concentration before treatment (Figure 3).

***Effect of extract on some biochemical parameters***

Extract administration of *Cochlospermum planchonii* roots (5, 100 and 150mg/kg.bw) results in the reduction in the amount of the biochemical enzymes in the serum, Alkaline phosphatase, Alanine Amino transaminase, Aspartate aminotransaminase, Bilirubin (Direct and Conjugate), Creatinine when compared with the untreated ulcerated groups and that of the un-induced ulcerated group Table 1.

***Effects of extract on hematological parameters***

The effect of the polyphenol rich extract and the standard drug on the hematological parameters (RBC, Hb, PCV, WBC and PLT) on rats induced ulceration was significant at 0.05 when compared to the level of the untreated ulcerated and the un-induced (Table 2).

***Effect of extract on antioxidant activity***

Antioxidant enzymes activities in the serum for induced ulcerated rats treated with PRECPR shows increase amount of superoxide Dismutase, Catalase and Glutathione reductase when compared with the untreated and un-induced groups.

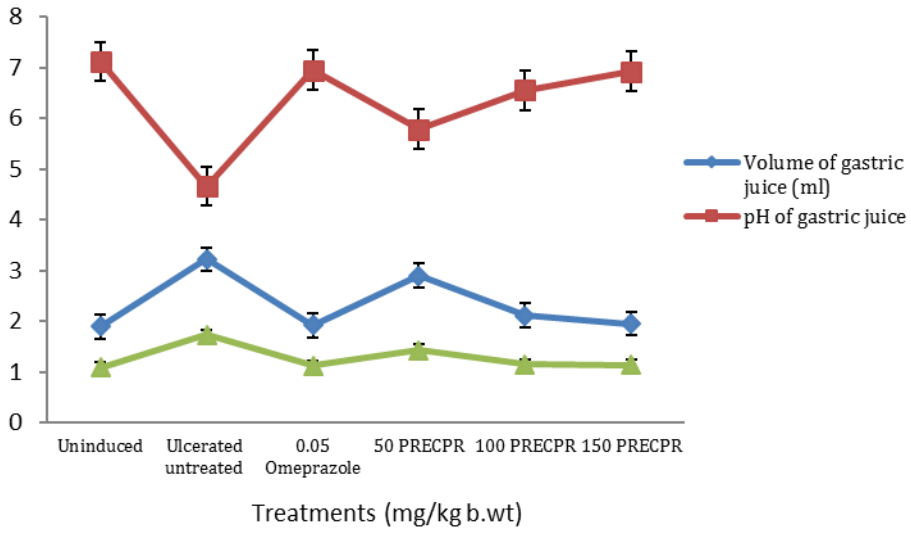


***Figure 1. Acid Secretory Parameters of the Gastric Aspirin-induced Ulcerated Rats Treated with Polyphenol-rich Extract of Cochlospermum planchonii Roots (PRECPR)***

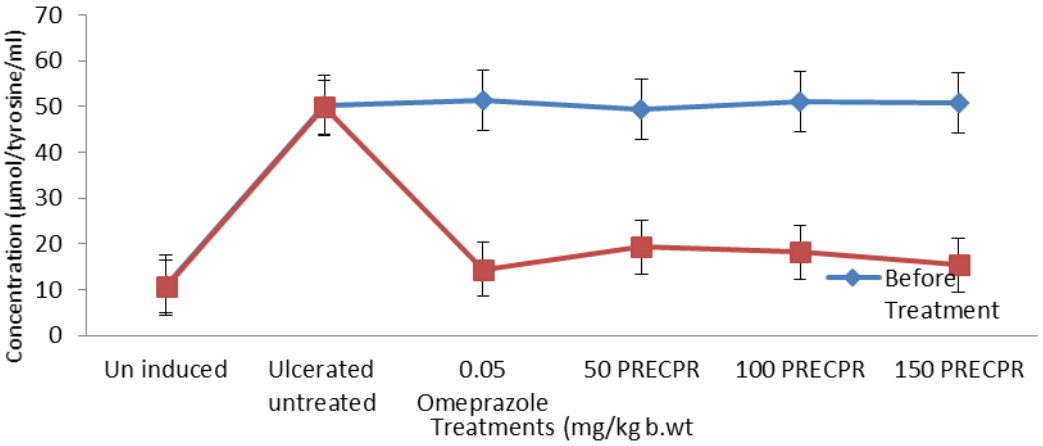


***Figure 2. Serum Pepsinogen Concentration (µmol/tyrosine/ml) in Aspirin-induced Ulcerated Rats treated with Polyphenol-rich Extract of Cochlospermum planchonii Roots (PRECPR).*** *Values are means of 5 determinations ± SEM. Values with superscript different from the control within the same column are significant different (p < 0.05)*

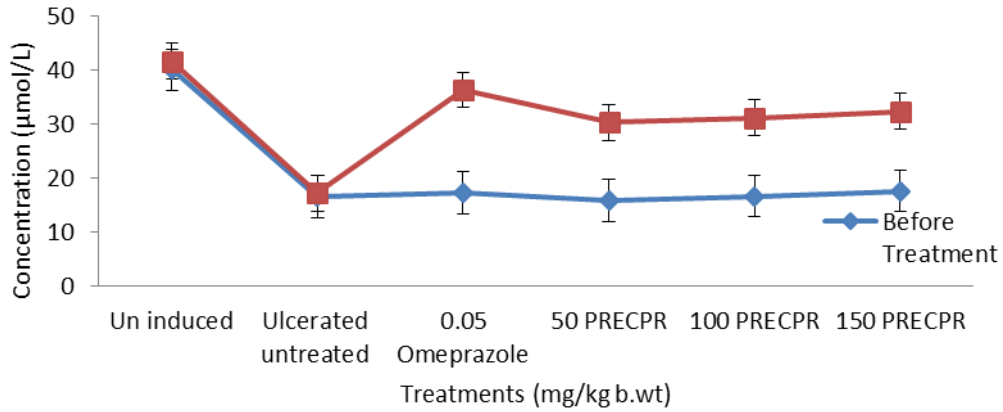


***Figure 3: Serum Nitric Oxide Concentration (µmol/L) in Aspirin-induced Ulcerated Rats Treated with Polyphenol-rich Extract of Cochlospermum planchonii Roots (PRECPR)****. Values are means of 5 determinations ± SEM. Values with superscript different from the control within the same column are significant different (p < 0.05).*

***Table 1. Liver and Kidney functions indices of Ulcerated Rats Administered Polyphenol-rich Extract of Cochlospermum planchonii Roots (PRECPR)***

| Treatments | Alkaline Phosphatase (IU/L) | Alanine Aminotransaminase (IU/L) | Aspartate Aminotransaminase (IU/L) | Direct Bilirubin (µmol/L) | Conjugate Bilirubin (µmol/L) | Creatinine (mg/dl) |
|---|---|---|---|---|---|---|
| Un-induced | $1.23 \pm 1.01^{a}$ | $2.45 \pm 2.11^{a}$ | $3.43 \pm 1.97^{a}$ | $3.22 \pm 3.42^{a}$ | $0.12 \pm 1.11^{a}$ | $3.23 \pm 4.21^{a}$ |
| Untreated ulcerated | $7.21 \pm 0.98^{c}$ | $9.32 \pm 1.11^{d}$ | $8.56 \pm 1.76^{d}$ | $14.23 \pm 2.67^{d}$ | $4.82 \pm 0.98^{d}$ | $22.18 \pm 2.82^{c}$ |
| Ulcerated + Omeprazole (0.05) mg/kg b.wt | $1.77 \pm 0.78^{b}$ | $3.05 \pm 1.98^{b}$ | 3.12 ± 2.11b | $5.94 \pm 1.98^{b}$ | $1.23 \pm 0.78^{b}$ | $10.34 \pm 3.43^{ab}$ |
| Ulcerated + 50 mg/kg b.wt PRECPR | $6.36 \pm 1.21^{c}$ | $7.23 \pm 1.02^{c}$ | $8.06 \pm 1.34^{c}$ | $11.23 \pm 2.11^{c}$ | $3.87 \pm 1.11^{c}$ | $18.32 \pm 2.97^{b}$ |
| Ulcerated + 100 mg/kg b.wt PRECPR | $4.44 \pm 1.18^{b}$ | $5.20 \pm 1.36^{b}$ | $6.00 \pm 1.99^{b}$ | $9.46 \pm 2.68^{c}$ | $2.60 \pm 0.77^{b}$ | $15.34 \pm 2.39^{b}$ |
| Ulcerated + 150 mg/kg b.wt PRECPR | $2.68 \pm 0.82^{b}$ | $3.34 \pm 1.98^{a}$ | $4.99 \pm 2.13^{a}$ | $6.63 \pm 2.00^{c}$ | $1.98 \pm 0.98^{b}$ | $12.44 \pm 3.23^{b}$ |

*Values are means of 5 determinations ± SEM. Values with superscript different from the control across the same row for each parameter are significant different (p< 0.05)*

***Table 2. Antioxidant Enzymes Activities in the Serum of Aspirin-induced Ulcerated Rats Treated with Polyphenol-rich Extract of Cochlospermum planchonii Roots (PRECPR)***

| Treatments | Superoxide Dismutase (SOD) (U/ mg tissue | Catalase (U / mg tissue) | Glutathione Reductase (GSH) (mg/g tissue) |
|---|---|---|---|
| **Uninduced** | $6.20 \pm 1.43^{a}$ | $3.12 \pm 0.58^{a}$ | **$18.32 \pm 3.35^{a}$** |
| **Untreated ulcerated** | $2.14 \pm 0.92^{d}$ | $1.22 \pm 0.23^{d}$ | **$8.23 \pm 1.14^{d}$** |
| **Ulcerated + Omeprazole (0.05) mg/kg b.wt** | $6.10 \pm 1.11^{b}$ | $3.11 \pm 0.64^{a}$ | **$17.32 \pm 2.22^{b}$** |
| **Ulcerated + 50 mg/kg b.wt PRECPR** | $5.01 \pm 1.12^{c}$ | $2.25 \pm 0.97^{c}$ | **$14.46 \pm 1.97^{c}$** |
| **Ulcerated +100 mg/kg b.wt PRECPR** | $5.89 \pm 0.95^{b}$ | $3.00 \pm 0.54^{b}$ | **$16.35 \pm 2.67^{b}$** |
| **Ulcerated +150 mg/kg b.wt PRECPR** | $6.12 \pm 1.11^{b}$ | $3.07 \pm 0.52^{a}$ | **$17.41 \pm 1.19^{b}$** |

*Values are means of 5 determinations ± SEM. Values with superscript different from the control across the same row for each parameter are significant different ($p < 0.05$).*

***Table 3. Hematological Parameters of Rats Administered Polyphenol-rich Extract of Cochlospermum planchonii Roots (PRECPR)***

| Treatments | RBC ($10^6$ /uL) | Hb (g/dl) | PCV (%) | WBC ($10^4$ /L) | PLT ($10^5$/ µL) |
|---|---|---|---|---|---|
| **Un-induced** | $7.06 \pm 0.23^{a}$ | $16.34 \pm 1.24^{a}$ | $41.33 \pm 1.76^{a}$ | $4.96 \pm 0.56^{a}$ | $222.32 \pm 10.11^{a}$ |
| **Untreated ulcerated** | $5.23 \pm 0.45^{c}$ | $12.45 \pm 1.08^{c}$ | $35.65 \pm 1.45^{c}$ | $8.45 \pm 0.44^{c}$ | $141.43 \pm 9.34^{d}$ |
| **Ulcerated + Omeprazole (0.05) mg/kg b.wt** | $6.96 \pm 0.56^{a}$ | $15.34 \pm 1.45^{b}$ | $41.43 \pm 1.33^{a}$ | $5.67 \pm 0.43^{b}$ | $243.11 \pm 12.43^{b}$ |
| **Ulcerated + 50 mg/kg b.wt PRECPR** | $6.56 \pm 0.45^{b}$ | $14.98 \pm 1.44^{b}$ | $39.33 \pm 1.56^{b}$ | $5.34 \pm 0.45^{b}$ | $195.34 \pm 10.32^{c}$ |
| **Ulcerated + 100 mg/kg b.wt PRECPR** | $6.59 \pm 0.33^{b}$ | $15.56 \pm 0.97^{b}$ | $40.44 \pm 0.86^{b}$ | $5.01 \pm 0.43^{a}$ | $225.13 \pm 11.12^{a}$ |
| **Ulcerated + 150 mg/kg b.wt PRECPR** | $7.00 \pm 0.45^{a}$ | $16.45 \pm 0.98^{a}$ | $40.56 \pm 1.21^{a}$ | $4.99 \pm 0.12^{a}$ | $238.21 \pm 9.45^{b}$ |

*Values are means of 5 determinations ± SEM. Values with superscript different from the control across the same row for each parameter are significant different ($p < 0.05$). RBC: Red Blood Cell, Hb - Haemoglobin , PCV – Packed Cell Volume;Concentration, WBC – White Blood Cell, PLT – Platelet Count.*

## DISCUSSION

The present study focusses on the antiulcerogenic and toxicological evaluation of polyphenol rich extract of *Cochlospermum planchonii* roots in tissue of Asprin-induced ulcerogenic rats. The increase in the gastric acidity and volume of the juice of rats (Figure 1) administered Aspirin shows the ability of the drugs to induced Ulcer, reason for its widely acceptance as an efficient experimental model to study ulcer in rats. The major mechanism by which it exhibits ulceration is by inhibiting the prostaglandins $H_2$ synthase, a key enzyme in the biosynthesis of prostaglandins (PGs) [25]. Thus, the increase in the aggressive factors aforementioned following the administration of Aspirin in this study confirmed that ulcerative stage has been established suggesting a good model for ulceration in rats. This finding is similar to those previous studies [26-28]. Likewise, the volume of the gastric juice and acidity are inversely proportional to the pH of the juice, this indicates that the low pH observed in this study is a reflection of the increase in gastric acid secretion due to aspirin administration. Hence, a significant rise in the pH due to the treatment by the extract portrays its antiulcerogenic activity which supports an earlier study [29].

Increase in Pepsin activity (Figure 2) correlates with increased acid secretion since acidification is required to activate the pepsinogen to pepsin [30] which account for the high pepsin activity for the untreated ulcerated group, whereas groups administered with the extracts and the standard drugs have low pepsin activity which is attributed to the effect of the extract and the drug. Therefore, the reduction in pepsinogen concentration exhibited by polyphenol-rich extract of *Cochlospermum planchonii* roots (PRECPR) shows that it might be portraying its antiulcerogenic character through suppression of acid secretion. This finding is tandem with some previous studies [31,32].

Inhibition of nitric oxide stimulation by depletion of prostaglandin synthesis has been implicated in ulceration [33] and this is confirmed from this study as aspirin was able to reduce the concentration of this metabolite thereby establishing an ulcerative condition. However, treatment with PRECPR at the three doses displayed marked increase in NO concentration (Figure 3) indicating its antiulcer efficacy. This protective effect of this plant on ulcer healing may be due to its inhibitory effect on gastric acid secretion caused by aspirin as this leads to simultaneous activation of the defensive factors in which NO is an important one. This is supported by the work of Abdulla *et al* (2019) who reported that keeping normal levels of nitric oxide is one of the main mechanisms used to protect gastric mucosa against harmful effects of the aggressive factors.

Hepatocellular necrosis or membrane damage leads to very high levels of some biochemical parameters such as serum Alanine phosphatase, Alanine and Aspartate aminotransferases release from liver to Circulation [35]. This is in consonance with the increased level of these enzymes as a result of induced ulceration with Aspirin in rats as shown in Table 1.0. Specifically, this increase seems to be a general property of all chemicals which provoke ulcer with aspirin inclusive [36] and the release of alkaline phosphatase has been suggested to play a role in tissue necrosis associated with various models of gastrointestinal ulceration [37]. This support the findings in this study in which increased activity of the enzyme in the serum was found after aspirin administration. This might be due to leakage of this enzyme from the liver and the intestinal mucosal to the blood fluid. However, it was observed that the extract was able to reverse the situation as noted in the decreased activity of the enzyme in the serum which implies that mucosal reconstruction and healing ulcer is implemented. Likewise, the integrity of the liver and the kidney will gradually be restored. This agrees with the previous studies by George and Iorliam (2004).

The elevated levels of conjugated (direct) bilirubin in the serum indicate that the liver is not clearing bilirubin properly. The result obtained for bilirubin in this study is well expected since there was a significant increase in serum Alanine phosphatase, Alanine and Aspartate aminotransferases activities showing a trace of liver dysfunction implying that bilirubin clearing ability of the liver has been compromised due to effect of aspirin in the presence of increasing biliary pressure. The ability of the extract to reverse the bilirubin clearing ability of the liver confirms that it has hepatorestorative ability arising from drug insult on the gastrointestinal tract. Creatinine is the most trustable renal marker and increases only when the majority of renal function is lost [38]. The use of nephrotoxicant like aspirin has been documented to increase serum creatinine levels and increase urinary creatinine level [39]. This statement supported the result obtained as the serum level of creatinine was elevated after aspirin administration. The extract however served as a nephroprotective agent by decreasing the serum creatinine level in a dose dependent manner. This result conforms to the report of Abdel-Moneim and Ghafeer (2007) who reported that nephroprotective agents reduces urea and creatinine levels in the blood. The data obtained from this study (Table 1) fully corroborated the previous reports. However, treatment with the extract was able to elevate the antioxidant defense system in a dose dependent manner indicating that the extract has antioxidant capability.

The haematological parameters give valuable information on the health status of an animal. In this study, aspirin was able to reduce Red Blood Cell (RBC), Haemoglobin (Hb), Packed Cell Volume (PCV) and Platelet Count (PLT) (Table 3). This is an indication that apart from the fact that induction of anaemia has set in, there is a possibility of decrease in oxygen carrying capacity of the blood as well as the amount of oxygen delivered to the tissues. Likewise, the reduction in the PLT suggests that aspirin was able to alter thrombopoietin production affecting blood clotting mechanism. However, the increase in WBC suggests that the body is trying to build immunity against the assault produced by aspirin since WBC and its components are responsible for immunological responses [40]. It has been reported that erythrocytes and platelets populate wound site at the initial stage of wound healing. Each of these blood cells has specific roles they play at the ulcer/wound sites [41]. The red blood cells help supply oxygen which reduces free radicals at site of ulcer while platelets release growth factors (GFs) which enhances ulcer healing. This increase in mucosal blood flow and delivery of essential nutrients is a major stage of ulcer healing as it prevents development of tissue necrosis [41]. The improvement in the levels of haematological variables might be due to the fact that polyphenol rich extract of *Cochlospermum planchonii* roots at the three doses tested helped in facilitating this initial ulcer healing irrespective of the aspirin administration.

The administration of aspirin has been documented to induce oxidative stress in the gastrointestinal tract by generation of ROS as well depletion of the antioxidant system thereby leading to ulceration [42]. Superoxide dismutase acts as the first line of defense to protect the tissue from toxic effect of superoxide radicals by converting it to relatively less toxic hydrogen peroxide. The hydrogen peroxide generated can be scavenged by catalase decomposing it into water and oxygen. Glutathione reductase also protects the gastrointestinal tissue from oxidative damage by detoxifying hydrogen peroxide and organic acid chemically. Therefore, depletion of these enzymic antioxidant systems by aspirin leads to gastrointestinal ulceration [43]. The data obtained from this study (table 2) fully corroborated the previous

reports. However, treatment with the extract was able to elevate the antioxidant defense system in a dose dependent manner indicating that the extract has antioxidant capability. This shows that the polyphenol rich extract of *Cochlospermum planchonii* roots protects against oxidative stress in the gastrointestinal tract. This is well expected as it has been proven to be rich in bioactive compounds known as polyphenols. This was why the focus of the work was on the polyphenol rich extract of the root of the plant as these molecules have been proven to have antioxidant ability thereby having many beneficial health effects *in vivo* and *in vitro* [44].

## CONCLUSION

This study shows that the polyphenol rich extract of *Cochlospermum planchonii* roots at the three doses attenuated aspirin-induced peptic ulcer and also did not interfere with the normal function of the body system. This gastrointestinal protective property of the extract could be possibly attributed to the presence of rich phytoconstituent especially the polyphenol which has been fractionated. Therefore, *C. planchonii* root could be a promising anti-ulcer agent as it compared favourably with omeprazole at both anti-ulcer and safety efficacies. However, further studies are required to isolate the active components and to elucidate their underlying mechanism of action.

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***Ethical Approvals***

The authors adhered strictly to the regulations governing the use of laboratory animals laid out by the Committee on Ethics for Medical and Scientific Research, University of Ilorin, Nigeria. Additionally, the accepted, internationally acknowledged ideals for the use and care of laboratory animals as outlined in the Canadian Council on Animal Care Guidelines and Protocol Review were also put into effect.

***Competing Interest***

The authors declare that they have no conflict of interest.

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# التقييم المضاد للتقرحات والسمية للمستخلص الغني بالبوليفينول من جذور *Cochlospermum Planchonii* في أنسجة الجرذان المتقرحة التي يسببها الأسبرين

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**المستخلص**

إن الاستخدام الشعبي لجذور Cochlospermum Planchonii كمضاد للقرحة وسلامتها لم يتم تأكيده علميًا بعد، وقد تم تصميم هذه الدراسة للقيام بذلك. قيمت هذه الدراسة النشاط المضاد للقرحة وسلامة المستخلص الغني بالبوليفينول من جذور Cochlospermum Planchonii (PRECPR) في الجرذان المتقرحة التي يسببها الأسبرين. تمت معالجة هذه الجذور لإعطاء جرعات 50 و100 و150 ملغم/كغم من وزن الجسم. تم تخصيص ثلاثين فأرًا (138.0 ± 5.0 جم) إلى ست مجموعات. تلقت الفئران في المجموعة (أ) (التحكم) 1.0 مل من الماء المقطر. تم إعطاء الأشخاص في المجموعات B - F 200 مجم / كجم من وزن الجسم من الأسبرين ثم عولجوا بـ 1.0 مل من الماء المقطر، 1.0 مل ما يعادل 0.05 مجم / كجم من وزن الجسم من أوميبرازول، 50 و 100 و 150 مجم / كجم من وزن الجسم من الأسبرين. بريكر، على التوالي. زاد PRECPR اعتمادًا على جرعة ($P < 0.05$) أكسيد النيتريك، ودرجة الحموضة، وأنشطة الإنزيمات، وتركيزات البيليروبين، والكرياتينين، ومؤشرات الدم، وانخفاض البيبسينوجين، وحجم وحموضة عصير المعدة بشكل ملحوظ. تمت مقارنة هذه النتائج بشكل إيجابي ($P <0.05$) مع تلك الخاصة بالمجموعة المعالجة بالأوميبرازول. قدمت هذه الدراسة إشارة قوية إلى أن هذا المستخلص يمكن أن يكون بمثابة عامل مضاد للقرحة وهو آمن.

**الكلمات الدالة**. مضاد للقرحة، كوكلوسبيرموم بلانشوني، بوليفينول، أسبرين، أوميبرازول.