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Effect of *Sterculia septigera* (Karaya Gum) on Aspirin-Induced Gastric Erosion in Adult Wistar Rats.

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ABSTRACT

The possible anti- ulcer effect of *Sterculia Septigera* on aspirin-induced gastric erosion in wistar rats has been investigated. Twenty five (25) wistar rats weighing between 150 and 200g were used and they were divided into five groups of five animals each. Group A served as control while groups B-E served as treatment group. Group B was administered aspirin only, group C was administered aspirin and ranitidine (ulcer drug) while groups D and E were administered orally with aqueous leaf extract of S*terculia septigera* at different doses of 200mg/kg and 400mg/kg body weight respectively for 14 days. The body weights were recorded before and after extract administration. The animals were sacrificed on the 15th day and histological sections of the stomach were analyzed. Observations in this study showed that administration of the aqueous extract of the leaves did not significantly reduce the body weights of the animals and it produced a remarkable ameliorative effect on the gastric erosion induced by aspirin with the lower doses (200mg/kg body weight) having a slightly higher potency than the higher dose (400mg/kg body weight). This could have been due to the direct or indirect excitatory effect on the production of prostaglandins on the mucus glands of the stomach. Prostaglandins have been suggested to enhance the production of mucous cells for protection of the gastrointestinal lining against erosion by acid secretion. Thus the extract produced better ameliorative effect than the standard drug (Ranitidine) in the Wistar rats. Therefore the use of this plant in place of ulcer drugs should be encouraged.

Key words: Gastric erosion, *Sterculia septigera*, Aspirin, Ranitidine.

INTRODUCTION

Gastric erosion has been defined as an endoscopically detectable superficial mucosal break that does not penetrate the muscularis mucosa[1]. The usual finding is a white base of erosion, although occasionally a blackened base may be seen as a mark of recent hemorrhage; the lesion are flat or minimally depressed and usually are surrounded by a narrow rim erythema [2].

Gastric erosion has also been defined as a defect in the mucosa with a necrotic base that is less than 3-5 mm in diameter [1]. The duration of erosion can be short term, chronic or recurrent [1,3]. The aetiology of gastric erosion of indeterminate duration has been postulated to involve Helicobacter Pylori, the use of non-steroidal anti-inflammatory drugs (NSAIDS), use of alcohol and cigarette smoking[4,5,6,7,8]. The conventional drugs used in the treatment of gastric mucosa damage include histamine (H_2) receptor antagonists, proton pump inhibitors, antacids and anticholinergics. However, most of these drugs have undesirable side effects and drug interactions [9]. Although few drugs like sucralfate and prostaglandin analogs [10] are being used as antiulcer substances, they may also have the risk of drug interactions, adverse effects and increased incidence of relapse during ulcer therapy[11]. Hence the search has been focused on natural products with antiulcer properties.

From ancient times, plants have been a powerful therapeutic agent for the treatment of various human diseases including those of gastrointestinal system. Approximately 60% of the world population relies almost entirely on plants for medication and natural products have long been recognized as important sources of therapeutically effective medicines [12].

Sterculia septigera of the *sterculia* specie is a plant found in West Africa region and commonly known as karaya gum. The leaves are green in color, smooth in texture, bitter in taste and have a mild odour[13]. Traditionally, the plant has been used for the treatment of boils, whitlow, inflammations, chicken-pox, measles, dysentery, syphilis, epilepsy, jaundices, malaria and leprosy [14,15,16]. The anti-bacterial and anti-fungal activities of dried bark, dried fruit and the root of *Sterculia septigera* against common microbes species

such as Bacillus Subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Escharichia coli, Aspergillusniger and Candida albicans have been reported [17].Phytochemical analysis of *Sterculia septigera* has revealed the presence of constituents which include: flavonoids, steroids, tannins, anthraquinones, alkaloids and carbohydrates [18].

As little or no reports are available on the possible antiulcer/anti gastric erosion effects of *Sterculia septigera*, the present work is aimed at investigating the effect of *Sterculia septigera* on aspirin-induced gastric erosion in adult wistar rats.

MATERIALS AND METHODS

Experimental Animals: Twenty-five (25) Wistar rats were used for this study. The rats were obtained from the Animal House in the Department of Anatomy, University of Benin, Benin city, and kept in the same location. They were housed in wire gauze cages at room temperature (25^0C). The animals were allowed to acclimatize for 3 weeks, during which they were fed on standard Top feed grower mash and water *ad-libitum*.

Plant Material: Leaves of *Sterculia septigera* were obtained from a village in Kebbi state, Nigeria. The plant was identified by its fruits and compared to the ones collected from the Plant Biology and Biotechnology department in the University of Benin where it was authenticated.

Plant Preparation and Extraction: The leaves of *Sterculia Septigera* were air dried for two weeks and pulverized into fine powder using mechanical grinder and stored in covered plastic container, out of which 2800g was weighed and soaked in 14litres of distilled water in a plastic bowl that was not covered. This mixture was stirred constantly for 3 days (72 hours) with the temperature kept at room temperature. The mixture was first filtered using a filter paper and conical flask and the solid residue removed. The filtrate was then re-filtered by passing it through cotton wool placed in Buchnner funnel severally. The final filtrate was concentrated using a rotary evaporator and water bath over a temperature of 45°C and then freeze dried. The solid residue left over after freeze drying was weighed, stored in a plain plastic bottle and kept in the refrigerator throughout administration period.

Animal Grouping: Twenty- five rats weighing between 150 and 200g were divided into five groups. Each group contained five rats and were labelled group A,B,C,D and E. where group A served as the control and groups B-E served as the experimental group. The study was carried out in compliance with the ethical policies outlined in the 'Guide for the Care and Use of Laboratory Animals 'published by the US National Institute of Health (NIH publication No. 85-23, revised 1996).

Determination of Body Weight: The body weights of the animals were taken using a digital electronic weighing balance (Gilbertini, Italy). Weights were taken before and after the experiment.

Experimental Design

Group A: This group of rats served as control and they were administered 1ml of distilled water daily for fourteen (14) days.

Group B: This group of rats were administered 200mg/kg of aspirin for fourteen (14) days to induce gastric erosion.

Group C: This group of rats were administered 200mg/kg of aspirin and the ulcer standard drug-Ramitidine at 100mg/kg for fourteen (14) days.

Group D: This group of rats were administered 200mg/kg of aspirin and 200mg/kg of *Sterculia septigera* aqueous extract for fourteen (14) days.

Group E: This group of rats were administered 200mg/kg of aspirin and 400mg/kg of the aqueous extract of *Sterculia septigera* for fourteen (14) days.

All treatments were administered orally and repeated every 24hr for fourteen days and 30mins of interval was maintained between interventions and aspirin. On the 15th day the rats were sacrificed under chloroform anaesthesia and the stomach was excised and observed grossly after which it was fixed in 10% formal saline. Standard histological methods and materials were used [19]. The tissue was processed histologically and sections were obtained using the hertz rotary microtome (Leica RRM2255, Cambridge model). The slides were prepared and stained with haematoxyline and eosin staining technique[20] and the histological changes were observed under the microscope at 100 X magnification.

Statistical Analysis: Data were presented as Means±SD and the significant difference was determined at $p \leq 0.05$ using the statistical package for social sciences (SPSS) version 16.0 (Inc Chicago, Illinois, USA).

RESULTS

Body Weight

Table 1 shows the initial and final mean weights of the control and treatment groups. There was no statistically significant decrease in the weights of all the groups throughout the period of experiment.

Histolgical Findings

The rats treated with the aqueous extract both in high (400mg/kg) and low (200mg/kg body weight) doses respectively produced a remarkable ameliorative effect with the lower dose having a slightly higher potency.

Figure 2: showed a cross section of the stomach of the control rats with normal architecture composed of mucosal lining, Gastric pit, muscularis gland and muscularis mucosal layer.

Figure 3: showed a patchy area of gastric mucosal erosion of the surface epithelium which is caused by aspirin administration.

Figure 4: shows a patchy superficial erosion of the surface epithelium of the mucosa of the stomach after aspirin and ranitidine was administered.

Figure 5: Showed an unremarkable mucosal lining and gastric pit after aspirin was administered and the subsequent administration of 200mg/kg body weight of *the aqueous extract of Sterculia septigera* .

Figure 6: showed an unremarkable mucosal lining of the stomach after the administration of 400mg/kg body weight of the extract.

Table 1: Initial and final mean weight values of the control group (A) and experimental groups(B-E)

GROUPS	Initial mean ± SEM	Final mean±SEM
A	205.0O± 7.63	191.66± 7.76
B	216.25 ± 6.88	195.00± 8.94
C	220.00 ± 30.33	218.00±30.23
D	213.33± 17.63	193.00± 8.88
E	200.00± 7.58	201.00±7.96

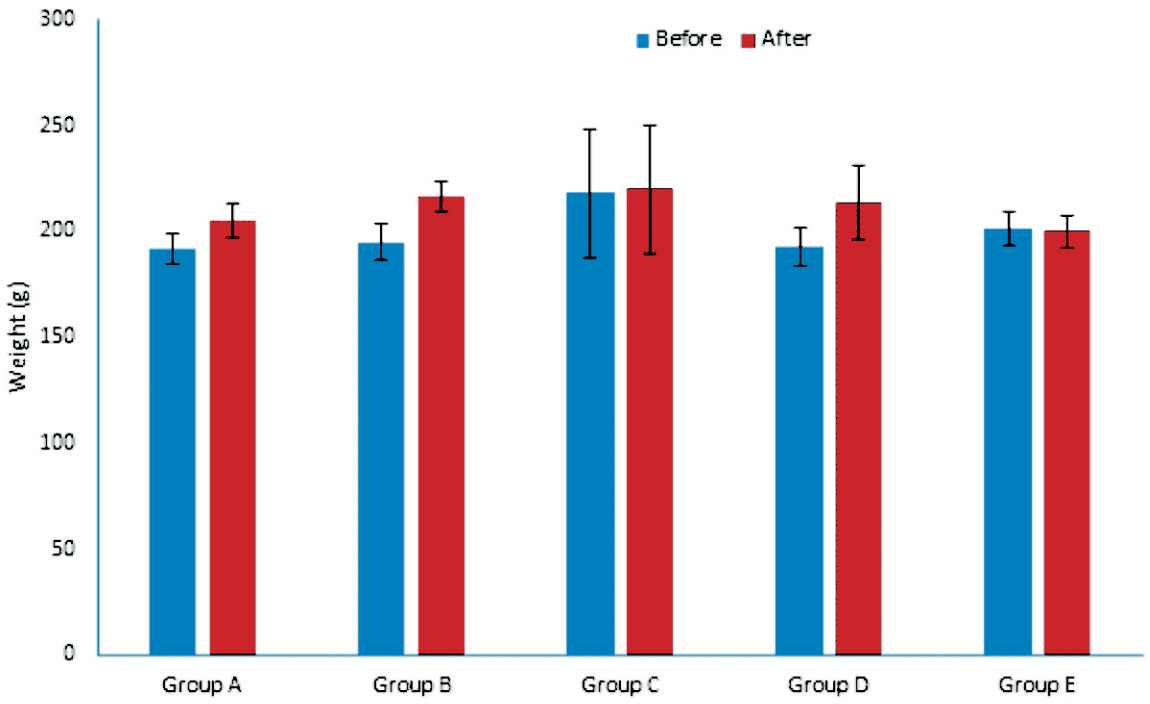

Figure 1: Bar chart illustrating the initial and final mean weight values of the control group (A) as compared to the treatment groups (Group B-E) after 14 days of extract administration.

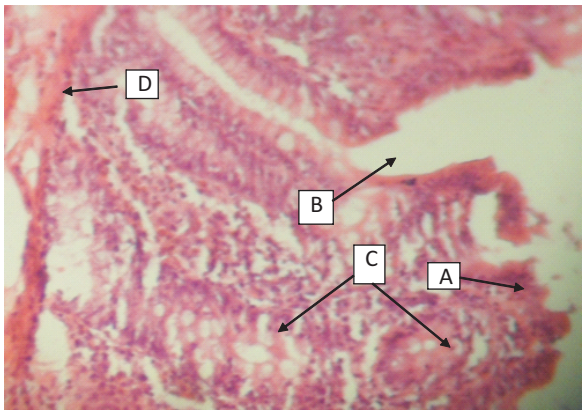

Figure 2: Photomicrograph of the stomach of control rat composed of: A.mucosal lining, B. gastric pit, C. mucosal glands and D. muscularis mucosa (H&E x 100)

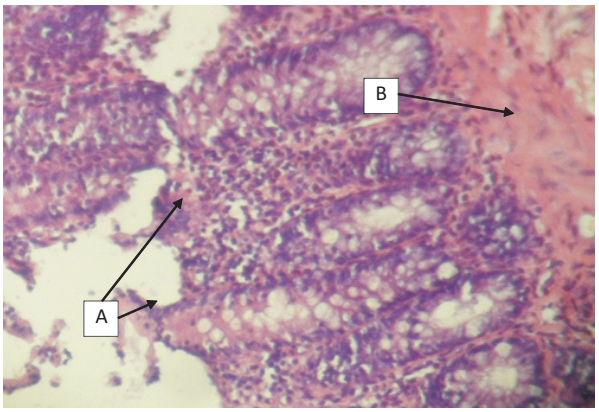

Figure 3: photomicrograph of the stomach of group B animals given Aspirin (200mg/kg) showing: A: patchy gastric erosion, B: muscularis mucosa (H&E x 100)

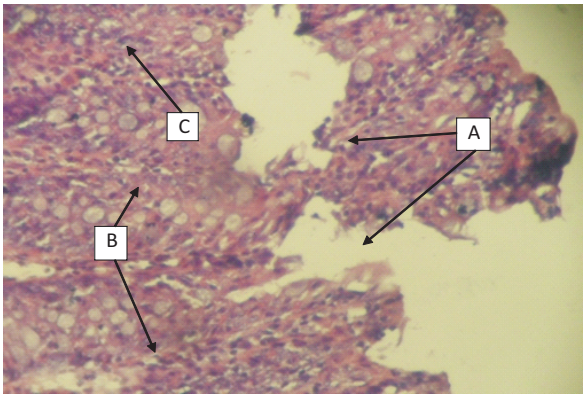

Figure 4: photomicrograph of the stomach of group C animals given Aspirin and Ranitidine showing: A. patchy superficial erosion, B. mucosal glands, C. lamina propria (H&E x 100)

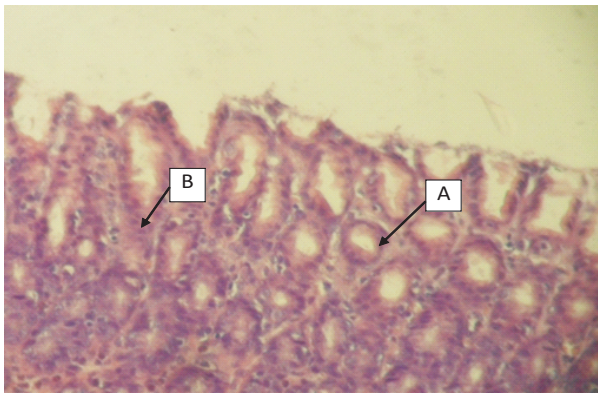

Figure 5: photomicrograph of the stomach of group D rats given Aspirin and low dose extract (200mg/kg body weight) showing: A. unremarkable mucosal lining, B. gastric pit (H&E x 100)

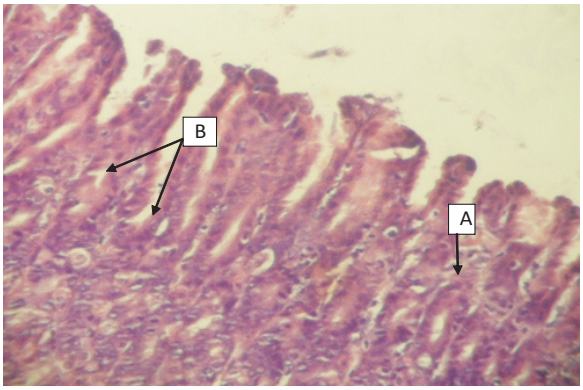

Figure 6: photomicrograph of the stomach of group E rats given Aspirin and high dose extract (400mg/kg body weight) showing: A. unremarkable mucosal lining and B. gastric pits (H&E x 100)

DISCUSSION

This study showed that the oral administration of the aqueous leaf extract of *Sterculia septigera* for 14 days at a dose of 200mg/kg and 400mg/kg body weight produced a remarkable ameliorative effect with the lower dose(200mg/kg) having a slightly higher potency.

Observations from this study showed that the weight reduction in the groups (group B-E) treated with *Sterculia septigera* for 14 days is not statistically significant when compared to the control group (group A).

The present study shows that there was a superficial defect in the mucosa that did not penetrate through the muscularis mucosae layer of the stomach with a blackened base which might be an indication of the haemorrhage observed in the mucosal lining of the treated animals (figure 3). It is postulated that an acid independent component in NSAIDS gastropathy causes microscopic erosions that are related to the inhibition of

prostaglandin synthesis [21]. This postulation therefore confirms the effectiveness of Aspirin given to rats in causing the mucosal lining erosion. After the 14th day of administration of *Sterculia septigera* , it was observed that the degree of erosion had decreased in direct response to the duration of dose Administered (figure 5 and 6).

We are of the opinion that *Sterculia septigera* could have an excitatory effect directly or indirectly on the production of prostaglandins. Prostaglandins have been suggested to have a protective role in the gastrointestinal tract. It enhances the production of mucous cells for protection of the gastrointestinal lining against erosion by acid secretion[22].

Observations from the concomitant administration of the aqueous leaf extract both in high (400mg/kg) and low (200mg/kg) doses respectively produced a remarkable ameliorative effect with the lower doses having a slightly higher potency. The reasons for this ameliorative effects is not known, but from previous studies the gastroprotective effects of *Sterculia septigera* was reported to be due to the presence of flavonoid and sapponins which protect the gastrointestinal mucosa from lesions[23]. The histological findings revealed this ameliorative effect.

CONCLUSION

Observation from this study has shown that the aqueous extract of St*erculia septigera* both in high and low doses respectively produced a remarkably ameliorative effect with the lower dose having a slightly higher potency .Thus the extract produced better ameliorative effect than the standard drug (Ranitidine) in the Wistar rats. Therefore the use of this plant in place of ulcer drugs should be encouraged.

RECOMMENDATIONS

It is recommended that the lethal dose toxicity of *sterculia septigera* extract should be investigated upon and the mechanism of action on Prostaglandin secretion should also be investigated.

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