ISSN No. 2456-4400
Int J Med Lab Res 2024, 9(2):1-12

IJMLR International Journal of Medical Laboratory Research

RESEARCH ARTICLE

THERAPEUTIC AND ANTAGONIST VILLI INSURGENCY OF GARCINIA KOLA ON ACETIC ACID INDUCED EROSIVE SMALL INTESTINAL ULCER OF WISTAR ALBINO RATS MODEL

Ilegbedion, Ikhide Godwin[1], Digban Awharentoma Kester[2], Beredugo Sylvanus[1], Okara, Nkemdinim Prudence[3], Odisi, Nelson Elaye[1].

[1]*Department of Medical Laboratory Science, Faculty of Basic Medical Science, College of Health Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.*
[2]*Department of Medical Laboratory Science, College of Medical and Health Sciences, Novena University, Ogume, Delta State Nigeria.*
[3]*Department of Histopathology, Faculty of Medical Laboratory Science, River State University, Port Harcourt, River State, Nigeria*

Received: 30 May, 2024 /Revision: 01 June, 2024 /Accepted: 30 June, 2024

ABSTRACT: The small bowel, also known as the small intestine, is a key component of the digestive system responsible for the majority of nutrient absorption from food. Positioned between the stomach and the large intestine, it receives digestive enzymes from bile and pancreatic juice via the pancreatic duct. The small intestine measures approximately 18 feet (6.5 meters) in length and is intricately folded to fit within the abdominal cavity. The *Garcinia Kola* plant was recognized by the Department of Pharmacology at Niger Delta University, located on Wilberforce Island, Amasomma, Bayelsa State. The seeds of this plant were collected from Amasomma and subjected to a drying process under natural sunlight for 14 days. Subsequently, they were ground into a fine powder and distributed into various beakers. After allowing the mixture to settle for three days, it was filtered using Watchman's No. 1 filter paper. For this research, thirty albino rats with weights ranging from 150g ± 3.5 to 205g ± 2.6 were utilized. These rats were sourced from the animal facility of the Pharmacology Department at Niger Delta University. They were kept in a controlled environment with temperatures maintained between 20°C and 27°C and a 12-hour cycle of light and darkness. The rats were grouped and provided with standard feed pellets from Guinea Feed Nigeria Plc and unlimited access to clean water for the duration of the study, which included a two-week acclimatization period. The handling of the animals adhered to the institution's guidelines for animal experimentation. The study spanned two months, with an initial four-week acclimatization phase. Post-acclimatization, the 30 rats were randomly assigned to seven groups (A to G). Group A (control) received a diet of pelleted growers feed (mash) and water. Group B (chronic exposure group) was given 1ml of 4% acetic acid orally, along with the standard diet, for 30 days. Group C (sub-chronic exposure group) received the same acetic acid treatment for 14 days. Groups D and E (sub-chronic exposure groups) were treated with acetic acid and varying doses of *Garcinia Kola* extract for 14 days. Groups F and G (chronic exposure groups) underwent a similar regimen with *Garcinia Kola* extract for 30 days. At the end of the treatment period, the rats were euthanized using chloroform anesthesia, and vital organs were harvested and preserved in 10% formalin. The tissues underwent standard histological processing and were stained with Haematoxylin and Eosin at the Histopathology laboratory of the Niger Delta Teaching Hospital (NDUTH) in Okolobiri. Histological examination revealed that the control group's villi and submucosal walls remained intact. However, plates 4.2 to 4.4 displayed erosion of the submucosal layer, interruption of the villi, and aggregation of white blood cells. Plate 4.5 indicated mild erosion of the mucosal layer and the presence of inflammatory cells. The findings suggest that oral ingestion of acetic acid for 30 days can cause inflammation and necrosis in the stomach tissues of lab animals. Additionally, it was noted that administering *Garcinia Kola* seed extract alone had minimal impact on the animals' histology.

Key words: *Garcinia Kola*, Acetic Acid, Small Intestine, Gastrointestinal tract, Formalin.

Corresponding Author:
Mr. Ilegbedion, Ikhide Godwin
Department of Medical Laboratory Science, Faculty of Basic Medical Science, College of Health Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

INTRODUCTION:

Garcinia Kola, commonly known as bitter kola (a term also used for G. afzelii), is a flowering plant species within the Mangosteen genus, Garcinia, part of the Clusiaceae family, also known as Guttiferae. This species is native to several countries in Africa, including Benin, Cameroon, The Gambia, Democratic Republic of the Congo, Ivory Coast, Mali, Gabon, Ghana, Liberia, Nigeria, Senegal, and Sierra Leone. Its preferred environment is the subtropical or tropical moist lowland forests [16].

For generations, the fruit, seeds (known as "bitter kola nuts"), and bark of this plant have been utilized in traditional medicine to remedy conditions ranging from coughs to fevers. The Center for International Forestry Research has noted that the trade of *Garcinia Kola* continues to play a significant role for the local populations and communities in Nigeria.Cola acuminata, the plant that yields the true kola nut, is not genetically related to *Garcinia Kola*, as it belongs to the Malvaceae family, not Clusiaceae. In African traditional medicine, *Garcinia Kola* is esteemed for its believed detoxifying, anti-parasitic, and anti-microbial qualities. The seeds are commonly employed to treat liver issues, bronchitis, infections of the throat, colic, and respiratory ailments such as colds and coughs. It is also popularly used as a chewing stick [16].

PROPERTIES OF *GARCINIA KOLA*

Antioxidant: Oxidative stress arises from the accumulation of free radicals and reactive oxygen species, which are byproducts of normal physiological processes in humans and can be detrimental if not neutralized [1]. The compound kolaviron has shown comparable efficacy to BHA as a natural antioxidant and liver-protecting agent in vivo [19]. The study indicates that G. kola seeds could help reduce oxidative harm in Wistar rats' livers caused by prolonged ethanol exposure. The antioxidant's phenolic content ranged from 10 to 21 mg/g, with a scavenging ability of 26% to 55%, suggesting its potential as a source of natural antioxidants and a food additive. The study demonstrated significant Ci 50 values (65.86–1.17 g/mL) and ferric ion reducing power (125.4–4.91 mg/mL) using radical trapping and ion conversion methods [10]. An increase in total white blood cell count, though not in hemoglobin, was observed, implying that the seeds may boost immunity, supporting their ethnomedicinal use. All antioxidant evaluations showed significant activity regardless of the method used [10].

Antibacterial: The overuse of synthetic antibiotics has led to bacterial resistance, linked to biological factors like membrane permeability, mutations, physiochemical alterations, and efflux dynamics in target microbes. Bacteria have a high capacity for developing and spreading resistance to commonly used antibiotics [28]. The global issue of antibiotic resistance has spurred the search for new antibacterial agents that could serve as raw materials for developing novel treatments. Certain bacterial strains from tooth decay showed that the ethyl acetate hexane fraction was most effective against Streptococcus viridans and Streptococcus mutans, with inhibitory activities at 0.33 mg/mL for both [5]. This supports traditional uses for toothache relief and cavity prevention. The extracts' antibacterial effects are likely due to their high tannin and flavonoid content. The most significant activity was against S. mutans and Bacillus subtilis at a concentration of 1.25 mg/mL (14 & 12 mm) [7]. Overall, the research suggests the seed has antimicrobial properties, and controlled consumption may help prevent intestinal bacterial infections. The review confirmed the antibacterial potential of plant extracts and the traditional therapeutic uses of plant parts [7].

Antifungal: The use of plant extracts for developing antifungal drugs is well-established. Such natural remedies have significantly contributed to human health. The extracts showed effectiveness against Aspergillus niger, with substantial antifungal properties compared to standard antibiotics [7]. The seed extract was highly active against Candida albicans and Aspergillus flavus in a fungistatic manner. The minimum inhibitory concentrations (MICs) for

ketoconazole, the standard drug, ranged from 275–691 µg/mL and 346–318 µg/mL, indicating the extract's potential to fight microbial diseases [5].

Antiviral: Research by Adefule-Ositelu et al. (2004) highlighted the extract's rapid alleviation of ocular symptoms, suggesting a promising treatment for adenoviral infections, especially where specific medications are unavailable. G. kola has shown effectiveness against viral infections in resource-limited settings.

Antihypertension: Hypertension, or high blood pressure, is characterized by consistently elevated arterial pressure, which can harm organs like the kidneys, heart, brain, and eyes. Rats on a G. kola-enriched diet showed a significant blood pressure reduction by the third week. G. kola contains a vasoactive substance that lowers blood pressure, although its exact mechanism remains unknown. Traditional medicine has long recommended G. kola for hypertension, and recent findings open avenues for new antihypertensive drugs or herbal formulations [9].

Anti-Inflammatory: Inflammation is a natural bodily response to injury or irritation, historically managed with plant-based remedies [26]. Treatments with concentrations of 25, 50, and 100 µg/mL inhibited cell growth in a dose- and time-dependent manner, indicating the presence of anti-inflammatory compounds that could be useful in conditions associated with cell proliferation and inflammation [2].

Antidiabetic: Diabetes mellitus, marked by hyperglycemia, affects vital organs over its chronic course. Currently, it impacts 463 million people globally, with projections of 578 million by 2030 [1]. Kolaviron-linked bioflavonoids at a dose of 100 mg/kg effectively alleviated hyperglycemic symptoms in diabetic rabbits without significant changes in glucose levels, HDL, or body weight. However, treated rats showed significantly lower glucose levels and a 66% reduction in LDL compared to controls. A 500 mg/kg dose of ethanolic seed extract resulted in a 49.70% decrease in blood glucose levels, supporting the seed's use in disease treatment and diabetes management. These findings validate the traditional medicinal use of the plants for diabetes treatment [28].

Antianalgesic: Managing pain, particularly chronic pain in the elderly, is a growing concern. The study demonstrated the compound's dose-dependent antinociceptive effects against acetic acid-induced pain in mice. All doses led to fewer pain responses compared to controls, indicating the seed's antianalgesic properties. The reviewed research supports the strong antianalgesic effects of bitter kola extract [23].

Antipneumonia: Pneumonia, an inflammatory condition of the lungs caused by infectious agents like fungi, bacteria, and viruses, can manifest in both acute and chronic forms. The study observed that the activity against Klebsiella pneumoniae increased as the concentration of kolaviron decreased, with significant efficacy noted at a dosage of 500 mg/kg. This suggests that bitter kola, due to its antimicrobial properties, could be an effective treatment for pneumonia [11].

Antiobesity: Obesity, a complex and chronic health issue, adversely affects the human body and increases the risk of various diseases, including diabetes, hypertension, and heart disease. With the number of obese individuals exceeding 300 million globally, the study noted a significant increase in red blood cell counts and a reduction in weight among the subjects. A dose-dependent decrease in very low-density lipoprotein levels and an increase in chylomicrons were observed, which are factors in cardiovascular diseases [31].

Fertility Evaluation: Medicinal plants have been utilized to enhance or regulate fertility for a long time. In the study, subjects were divided into groups receiving different doses of extracts, with one group serving as a control. The results indicated that higher doses might negatively impact sperm quality and testicular structure, suggesting that excessive consumption could be detrimental to male fertility.

The extract showed an antispermatogenic effect, highlighting the need for controlled consumption [3].

Antiglaucoma: Glaucoma, a leading cause of permanent blindness worldwide, is characterized by progressive optic nerve damage. The study found that oral intake of the extract reduced intraocular pressure by 21% in healthy individuals, suggesting potential benefits for patients with primary open-angle glaucoma or ocular hypertension, especially in low-income regions [22].

Ingestion: The study revealed significant reductions in erythrocyte count, packed cell volume (PCV), and hemoglobin concentration, indicating that the active component does not have long-term toxicological effects when evaluated on mammalian erythrocytes [8].

Geotactic Behavior: Geotaxis, an innate behavioral response in living species, involves movement toward or away from the Earth's gravity. The study showed that flies fed a diet enriched with G. kola seed had increased GST and catalase activities, while nitric oxide content was significantly reduced compared to controls [8].

Steroid Hormones: The data suggest that the seed extract influences the regulation of cortisol, potassium, and sodium secretion. However, due to its depressant nature, the extract should be used cautiously [18].

Growth Performance: Feeding G. kola seed powder to Clarias gariepinus fingerlings improved growth rate, feed utilization, and survival, with significant differences in growth metrics and food conversion ratio observed. The fish fed diets containing 1.0 g/kg ethanolic seed extract showed the most weight gain, supporting the plant's probiotic benefits as a growth promoter [30].

Healing of Liver Injury: The liver, crucial for metabolic and secretory functions, is sensitive to drugs affecting biotransformation. The study found that a combination of two plants had a therapeutic effect on healing liver injury, supporting its traditional use in treating liver infections and suggesting potential for drug development [26].

Small Intestine: The small intestine, also known as the small bowel, is a crucial organ within the gastrointestinal tract responsible for the majority of nutrient absorption from food. Positioned between the stomach and the large intestine, it receives digestive enzymes from bile and pancreatic juice via the pancreatic duct. The small intestine measures approximately 18 feet (6.5 meters) in length and is intricately folded to fit within the abdominal cavity [25]. Despite being longer than the large intestine, it is referred to as the small intestine due to its smaller diameter. It comprises three distinct sections: the duodenum, jejunum, and ileum. The duodenum is the initial and shortest segment where the absorption process begins, facilitated by villi, which are tiny, finger-like projections. The jejunum's primary role is to absorb nutrients through its lining, which contains enterocytes that process small, previously digested nutrient particles. The ileum's main function is to absorb vitamin B12, bile salts, and any remaining digestive products not absorbed by the jejunum [6].

The small intestine (small bowel) lies between the stomach and the large intestine (large bowel) and includes the duodenum, jejunum, and ileum. The small intestine is so called because its lumen diameter is smaller than that of the large intestine, although it is longer in length than the large intestine [27].

The duodenum continues into the jejunum at the duodenojejunal junction or flexure, which lies to the left of L2 vertebra and is fixed to the retroperitoneum by a suspensory ligament of Treitz. The inferior mesenteric vein (IMV) lies to the left of the duodenojejunal junction. There are several peritoneal fossae around the duodenojejunal flexure, which may be the sites of an internal herniation of the small bowel. The rest of the small intestine is a 4-6-m long convoluted tube occupying the center of the abdomen and the pelvis, surrounded on 2 sides and above by the colon (a part of the large intestine). The ileum continues into the large intestine (cecum) at the

ileocecal junction [27]. The typical length in a living person is 3m–5m. The length depends both on how tall the person is and how the length is measured. Taller people generally have a longer small intestine and measurements are generally longer after death and when the bowel is empty [15,32].

It is approximately 1.5 cm in diameter in newborns after 35 weeks of gestational age, and 2.5–3 cm (1 inch) in diameter in adults. On abdominal X-rays, the small intestine is considered to be abnormally dilated when the diameter exceeds 3 cm Ali Nawaz *et al*., 2016. On CT scans, a diameter of over 2.5 cm is considered abnormally dilated. The surface area of the human small intestinal mucosa, due to enlargement caused by folds, villi and microvilli, averages 30 square meters [24].

Acetic Acid: Acetic acid, with the systematic name ethanoic acid, is an acidic, colorless liquid organic compound with the chemical formula:CH_3COOH, (alternatively written as CH_3CO_2H, C_2H_4O_2 or HC_2H_3O_2). Vinegar contains a minimum of 4% acetic acid by volume, making it the primary component of vinegar, aside from water and trace elements [14].

Acetic acid is the second simplest form of carboxylic acid, following formic acid, and features a methyl functional group. It serves as a significant chemical reagent and industrial chemical, mainly used in producing cellulose acetate for photographic film, polyvinyl acetate for wood adhesive, and various synthetic fibers and fabrics [17]. In domestic settings, diluted acetic acid is frequently used as a descaling agent. Within the food industry, it is regulated under the food additive code E260, serving as an acidity regulator and flavoring agent. Biochemically, the acetyl group, derived from acetic acid, is vital to life. When linked to coenzyme A, it becomes a central component in the metabolism of carbohydrates and fats [17].

The worldwide demand for acetic acid stands at approximately 6.5 million metric tons annually, with around 1.5 million metric tons satisfied through recycling, while the rest is produced from methanol. Vinegar is predominantly a diluted form of acetic acid, typically created through the fermentation and subsequent oxidation of ethanol [14].

MATERIALS AND METHODS:

Location of Study: The study was carried out in Department of Medical Laboratory Science, Faculty of Basic Medical Sciences, College of Health Sciences, Niger Delta University, Wilberforce Island Amasomma, Bayelsa state.

Identification: The plant *Garcinia Kola* was identified by Department of Pharmacology, Niger Delta University Wiberforce Island, Amasomma Bayelsa state.

Procurement Of *Garcinia Kola* Extract: The seeds of the plant *Garcinia Kola* were obtained from Amasomma Bayelsa State.

EXTRACTION OF GARCINIA KOLA EXTRACT

Plant material: The seeds of were extracted via various processes:

The seeds of *Garcinia Kola* were dried using the atmospheric temperature of the sun for 14 days and blended into fine powder, separating them into the different beakers which weight were as followed: Beaker 1 weighed 135.2g, Beaker 2 weighed 126.9g and Beaker 3 weighed 133.3g respectively. The beakers were placed in a water bath and heated at 60°c for 6 hours.

Extracts used were measured according to the various beakers which were as follows:

Beaker 1 carried 21.7g of extract and was dissolved in 108.5ml of distilled water.

Beaker 2 Carried 19.2g of extract and was dissolved in 96ml of distilled water.

Beaker 3 carried 18.9g of extract and was dissolved in 94ml of water.

These mixtures were allowed to settle down for 3 days and filtered using watchman's No. 1 filter paper.

Animal Housing: Thirty albino rats weighing between 205g+ 2.6-150g+ 3.5 were used for this study. These rats were obtained from the Animal house of the Pharmacology Department of Niger Delta University, Bayelsa State, Nigeria. They were housed under standard condition of temperature (27- 20C) with twelve hours light and dark periodicity. These animals were housed in clean gaitzed in groups and fed on standard feed pellets (Guinea feed Nigeria Plc) and clean water ad libitum throughout the duration of the study. ACC limatization was for two weeks. Animals were handled in the study according to institutions guidelines for experiments involving the use of animals.

Table 1 Experimental designs showing groups and administration of extract and Lead.

Group A	Group B	Group C	Group D	Group E	Group F	Group G
4	4	5	4	4	4	5
Food and water only	Acetic Acid (1ml) +Food and water for 30 days.	Acetic Acid (1ml) +feed and water for 14 days	Acetic Acid(1ml) + *Garcinia Kola* Extract (200mg/kg) + feed and water for 14 days	Acetic Acid (1ml) + *Garcinia Kola* Extract (100mg/kg) + feed and water for 14 days.	Acetic Acid (1ml) + *Garcinia Kola* extract (200mg/kg) + feed and water for 30 days.	Acetic Acid (1ml) +*Garcinia Kola* extract (100mg/kg) + feed and water for 30 days

Experimental Design: The rats were weighed and divided into seven group. The duration of this study was for two months, the animals were allowed to acclimatize for four weeks. After the acclimatization period 30 rats were randomly divided into 7 groups (A, B, C, D, E, F and G) **(Table.1)**.

Group A rats (control) were administered orally with pelleted growers feed (mash) and water throughout the experiment

Group B rats (chronic group) rats were orally administered with acetic acid only (1ml of 4% acetic acid) and given growers feed (mash) and water for 30 days.

Group C (Sub-chronic group) were administered orally with acetic acid (1ml of 4% acetic acid) for 14 days, and pelleted growers feed (mash) throughout the experiment for 14 days.

Group D (Sub-chronic group) rats were administered orally with Acetic Acid (1ml of 4% acetic acid) and High Dose of *Garcinia Kola* extract for 14 days and they were given growers pellet feed (mash) and water throughout.

Group E (Sub-chronic group) rats were administered orally with Acetic acid (1ml of 4% acetic acid) and Low Dose of *Garcinia Kola* extract for 14 days and growers pellet feed (mash) and water throughout the experiment.

Group F rats (Chronic group) were administered orally with Acetic Acid (1ml of 4% acetic acid) and high dose of *Garcinia Kola* extract for 30 days.

Group G rats (Chronic group) were administered orally with Acetic Acid (1ml of 4% acetic acid) and low dose of *Garcinia Kola* extract for 30 days.

Study duration: The study lasted between February, 2022 to April, 2022. It took a period of 8 weeks, four weeks acclimatization and two weeks substance administration for Sub-chronic group and 4 weeks of substance administration for Chronic group.

Route of administration: Acetic Acid was administered orally

Bitter kola (Garcinia *Kola*) extract was administered orally using orogastric tube

Sample collection: Upon completion of the weeks of substance administration, the animals were sacrificed by administering chloroform as anesthetic substance. The rats were dissected to harvest the organs of importance which was fixed immediately with 10% formalin.

Tissue processing: The tissue was processed according Histological standard tissue processing, embedded, sectioned and stained using Haematoxylin and Eosin staining procedure at the Histopathology laboratory of Niger Delta Teaching Hospital (NDUTH) Okolobiri.

Staining Protocol: Sections were de-waxed 2 changes of xylene until all the wax was removed and sections were hydrated in descending grades of alcohol starting from absolute, 80% alcohol, 70% alcohol, 50% alcohol and finally water.

Sections were stained with Harris Hematoxylin for 15 minutes and the sections were rinsed in water. Tissue sections were differentiated in 1%acid alcohol until the nucleus retains the stain then the sections were blued in Scot tap water for 2minutes and Counterstaining was done using Eosin for 2minutes. Sections were dehydrated in ascending grades of alcohol (50%, 70% 80% and absolute alcohol) and were clear and mounted using a DPX and viewed using a microscope.

Sample Size Calculation: Taro Yamane formula with 95% confidence level according to Yamane, 1973, was used to determine the sample size of this research (Yamane, 1973).

Calculation of sample size using the Taro Yamane method

$$n = \frac{N}{1+N(e)2}$$

Where n = sample size required

N = Population size

e = Allowable error which is between 0.01-0.05

Assuming N=25 and e =0.1, therefore

$$n = \frac{100}{1+100(0.1)2}$$

Therefore, n = 25

RESULTS:

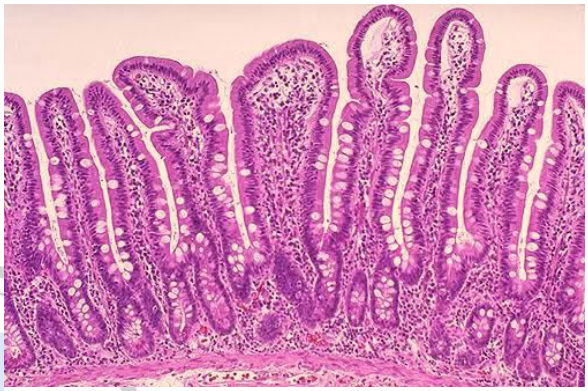

Plate 4.1 Shows the Morphology of the small intestine after the administration of the various treatments for one-month days. Slide shows normal morphology of the small intestine, intact mucosa layer (M) with well-defined villi (V),intact crypts and submucosa layer (SM).(X40).

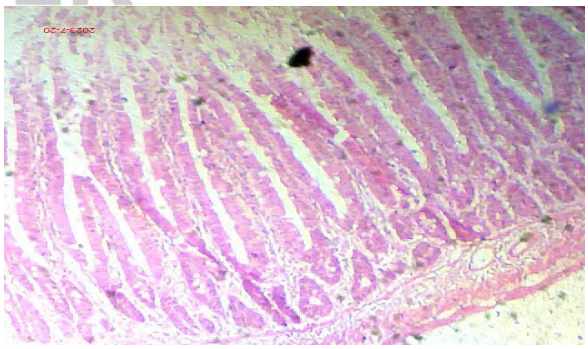

PLATE 4.2: Shows the Morphology of the small intestine after the administration of the various treatments for 14 days. Slide shows erosion of the mucosa layer (M)as well as disintegration of the villi(V). There is also loss of the crypts (X10) H&E. substance administered toxic to the small intestine

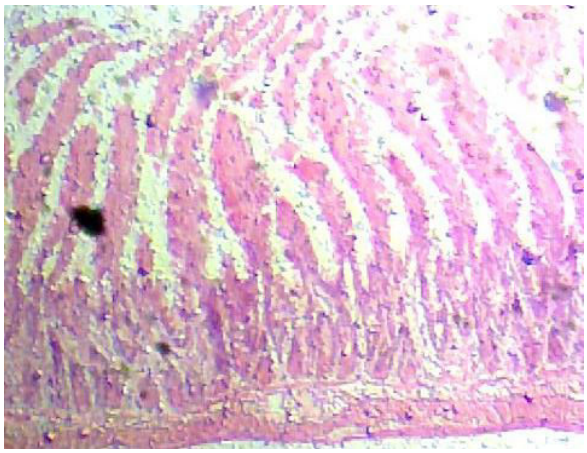

PLATE 4.3: Shows the Morphology of the small intestine after the administration of the various treatments for one month. Slide shows disintegration of the mucosa layer (M)with the necrosis of the villi (V) and with total loss of the crypts(I) (X10) H&E. substance administered toxic to the small intestine

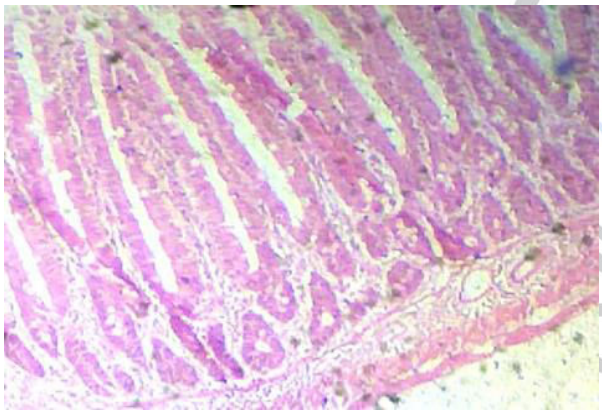

PLATE 4.4: Shows the Morphology of the small intestine after the administration of the various treatments for 14 days. Slide shows mild erosion of the mucosa layer (M)with the villi and loss of the crypts(I) (X10) H&E.

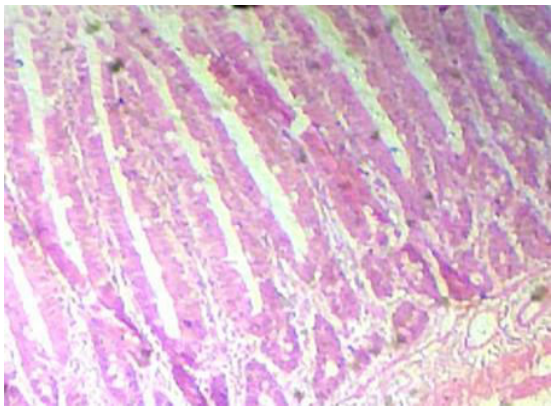

PLATE 4.5: Shows the Morphology of the small intestine after the administration of the various treatments for 14 days. Slide shows mild erosion of the mucosa layer (M)with the villi and loss of the crypts(I) (X10) H&E

STATISTICAL ANALYSIS:

Data analysis carried out by Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA).

	FREQUENCY	PERCENT
GROUP A	04	16
GROUP B	04	16
GROUP C	04	16
GROUP D	03	12
GROUP E	04	16
GROUP F	01	04
GROUP G	05	20
TOTAL.	25	100

KEY

GROUP A: Control

ACUTE STUDY (2 WEEKS).

GROUP B: Acetic acid

GROUP C: Acetic acid

GROUP D: Acetic acid + high dose extract

GROUP E: Acetic acid + low dose extract

SUB-CHRONIC STUDY (1 MONTH)

GROUP F: Acetic acid + high dose extract

GROUP G: Acetic acid + low dose extract

Figure 2: FREQUENCY DISTRIBUTION CURVE

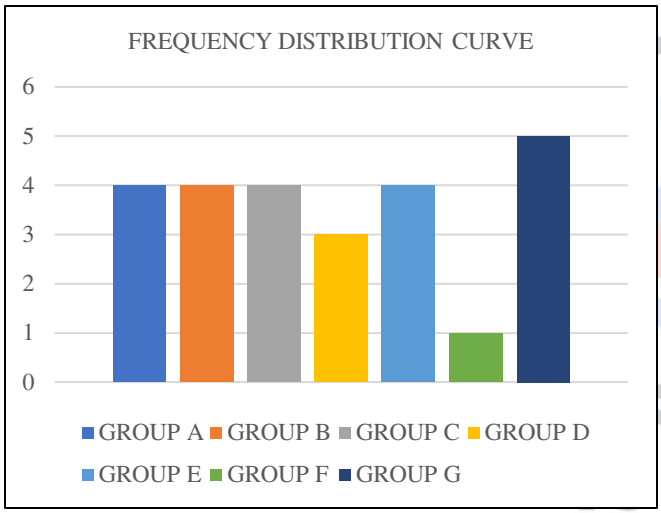

Table 2: FREQUENCY DISTRIBUTION TABLE

	FREQUENCY	PERCENT
GROUP A	04	16
GROUP B	04	16
GROUP C	04	16
GROUP D	03	12
GROUP E	04	16
GROUP F	01	04
GROUP G	05	20
TOTAL	25	100

DISCUSSION:

PLATE 4.1 Shows the Morphology of the small intestine after the administration of the various treatments for one-month days. Slide shows normal morphology of the small intestine, intact mucosa layer (M) with well-defined villi (V), intact crypts and submucosa layer (SM).

PLATE 4.2 The "villous atrophy" or "intestinal villous atrophy." This condition is characterized by erosion and damage to the mucosa layer, disintegration of the villi, and loss of the crypts. Villous atrophy is commonly associated with certain diseases, such as celiac disease, tropical sprue, and certain infections. The condition leads to impaired absorption of nutrients, which can result in malabsorption and various gastrointestinal symptoms.

PLATE 4.3 The morphological findings indicated in plate 4.3 after one month of treatment indicate severe damage and degeneration. The observed changes, including disintegration of the mucosa layer, necrosis of the villi, and total loss of the crypts, suggest a highly detrimental effect on the intestinal tissue.

PLATE 4.4 and PLATE 4.5 shows mild erosion of the mucosa layer (M) along with the presence of villi and loss of the crypts (I), it suggests a less severe form of tissue damage compared to the previous description.

CONCLUSION:

Garcinia Kola, also known as bitter kola, is a tropical flowering plant native to West Africa. It is widely used in traditional medicine for its various potential health benefits. The study suggests that the administration of *Garcinia Kola* may have a beneficial effect on mitigating or reversing the toxic effects of acetic acid on the small intestine.

In these experimental studies like this, animals (usually rodents) were used as subjects to investigate the potential therapeutic properties of natural compounds like *Garcinia Kola*. The researchers would evaluate the extent of damage to the small intestine in

all groups, including the experimental group treated with *Garcinia Kola*. Perhaps garcinol, due to the relatively promising pharmacological activity (e.g. anticancer, antimicrobial, neuroprotective activities) deserves a deeper scientific interest. However, it is also likely that the substances potentially responsible for the pharmacological properties of the bitter kola have not yet been discovered. It is also possible that the constituents in G. kola work in synergy and, when isolated, will not provide such results as in the form of complex mixture in the natural material (as for example seen in the case of rauwolfia alkaloids). Hopefully some human clinical trials will be performed with the extracts/compounds from G. kola in the future and a promising candidate will emerge with the potential of becoming an important lead for the drug development. Research into the pharmacological benefits of medicinal plants provides us with critical knowledge for better organizing current and future studies to address a variety of human illnesses. G. kola is a remarkable medicinal plant with a variety of traditional usage that has been documented since antiquity.

RECOMMENDATION: Preclinical investigations have already been conducted on a variety of biological activities. The seeds were found to have significant biological activity, and this is due to the *G. kola* containing nutritionally and pharmacologically essential compounds. Research into the mechanisms behind the bioactivity of the constituent chemical components is required. As a result, well-designed clinical trials are recommended to obtain more conclusive evidence about the usefulness of *G. kola* seeds.

COMPETING INTEREST: No competing interest.

ACKNOWLEDGEMENTS: We acknowledge with sincere thanks, Sct's Ernest Ernestba Egba, Tobi, Tonye and Akange, Beeter Nicodemus for making this work possible.

REFERENCES:

[1]. Abdulrahman M. D, Ali A. M, Fatihah H N N, Khandaker M M, & Mat N (2018b). Traditional medicinal knowledge of Malays in Terengganu, Peninsular Malaysia. Malayan Nature Journal, 70,3: 349-364.

[2]. Adedapo A, Omobowale T, Oyagbemi A, Yakubu M, & Oyekan A. (2015). The methanol extract of *Garcinia Kola* seed blunts lipopolysaccharide (LPS)-and angiotensin II-induced cell proliferation as well as nitric oxide production in in vitro vascular smooth muscle cells (VSMC) assay. *FASEB Journal*. 2015;29,23: 773–786

[3]. Adefule-Ositelu A, Adefule A, & Omilabu S. (2004). Clinical evaluation of ocular antiviral effect of *Garcinia Kola*nut water extract in epidemic haemorrhagic keratoconjunctivitis in Lagos. Nigerian *Quarterly Journal of Hospital Medicine*. 2004;14,3: 270–276.

[4]. Afolabi C, Akinmoladun E O. and Dan-Ologe I A. (2007). Phytochemical constituents and antioxidant properties of extracts from the leaves of Chromolaena odorata. Scientific Research and Essay 2007;191-194.15.

[5]. Ajayi T, Moody J, Adeyemi T, Fakeye T, & Ngere L. (2008). Antimicrobial activities of *Garcinia Kola* seeds extract on dental caries-causing microorganisms. *Planta Medica.* 2008;74,9: 74–257.

[6]. Arthur J Jr, Natalie A T, Gary D W, Lindsey G A (2020). "Cellular and molecular gastroenterology and hepatology 2020;9,1: 33-45.

[7]. Babandoko A M, Ojo K R M, Elizabeth A A, & Kamoldeen A A. (2012). Antimicrobial effects of *Garcinia Kola* (bitter kola) on some selected pathogens from University of Ilorin Teaching Hospital Ilorin, Nigeria. *Journal of Asian Scientific Research*. 2012;2,4:159–169.

[8]. Bae J E, Bang S, Min S (2016). "Positive geotactic behaviors induced by geomagnetic field in Drosophila," Molecular Brain. 2016; 9,1:55–63.

[9]. Baharvand-Ahmadi A, Bahmani M, Tajeddini P, Rafieian-Kopaei P and Naghdi N (2016). "An ethnobotanical study of medicinal plants administered for the treatment of hypertension," Journal of Renal Injury Prevention. 2016; 5, 3:123–128.

[10]. Ban N C, Georgina G G, Nadine A M, Charlotte K W, Morena M, Stefan G (2019). Sara Jo Breslow Nature sustainability 2019;2, 6: 524-532.

[11]. Calista D, Dozie N, Kingsley N, Catherine O and Felicia O (2020). "Effects of kolaviron on pneumonia-like infection induced in albino Wistar rats. Anti-inflammatory & anti-allergy agents in medicinal chemistry," Medicinal Chemistry. 2020; 202:219–227.

[12]. Centers for Disease Control and Prevention (2015). "Radiation and Your Health". Retrieved 28 February 2024.

[13]. Chikere U O, Gloria O C, Nnabuihe E D, Uchechi, E.E.,Jesse A.C (2015). Advances in Life Science and Technology 2015; 33: 18-25.

[14]. Daiana R D, Bernard, R G (2020). "Applied microbiology and biotechnology 104, 8607-8619.Abdulrahman, M. D., ALI, A. M., Fatihah, H. N. N., Khandaker, M. M., & Mat, N. (2018a). Morphological and anatomical Studies of Syzygium polyanthum (Wight) Walp. (Myrtaceae). Malayan Nature Journal, 2018;70,3: 309-322.

[15]. DiBaise J K, Parrish CR, Thompson J S. (2016). Short Bowel Syndrome: Practical Approach to Management. CRC Press. p. 31. ISBN 9781498720809.

[16]. Dogara A I, Labaran S W, Hamad A A, Lema and Jakada B H (2021). "Traditional medicinal plants used for the treatment of cancer in Mubi, Adamawa state, Nigeria," Al-Qadisiyah Journal of Pure Science, 2021;26,4: 258–268.

[17]. Downs A J, Adams C J. (2017). The Chemistry of Chlorine, Bromine, Iodine and Astatine: Pergamon Texts in Inorganic Chemistry. Elsevier. ISBN 978-1-4831-5832-7.

[18]. Falana O, Smith O, Gazal O (2013). "Effects of bitter cola (Garcinia cola) extract on steroid hormones and selected electrolytes in West African dwarf bucks," Indian Journal of Animal Research. 2013; 47,4:273–282.

[19]. Farombi E O, Akanni O O, & Emerole G O. (2002). Antioxidant and scavenging activities of flavonoid extract (kolaviron) of *Garcinia Kola* seeds. *Pharmaceutical Biology*, 2002; 40:107–116.

[20]. Farombi E O, Tahnteng J G, Agboola A O, Nwankwo J O, & Emerole G O. (2000). Chemoprevention of 2-acetylaminofluorene-induced hepatotoxicity and lipid peroxidation in rats by kolaviron-A *Garcinia Kola* seed extract. *Food and Chemical Toxicology*, 2000; 38,6:535–541.

[21]. Hossain R A, Owegby, A.G., Waterman, P.G. (2007). "Kolanone, a novel polyisoprenylated benzophenone with antimicrobial properties from the fruit of *Garcinia Kola*. Planta Med. 2007; 44,44:78–81.

[22]. Ilechie A A, Jeduah M M, Abraham C H, (2020). "Oral consumption of *Garcinia Kola* (bitter kola) lowers intraocular pressure," Acta Ophthalmologica. 2020; 98,8:1028–1033.

[23]. Iniaghe L O and Onyemaonyeoru A I (2015). "Evaluation of the analgesic property of the ethanolic extract of *Garcinia Kola* Heckel (Guttiferae) seeds in mice," Journal of Science and Practice of Pharmacy. 2015; 2,1:46–50.

[24]. Jude A I, Chekwube A C, & Hannah O N. (2020). Phytochemical screening and antimicrobial activity of methanol extract of *Garcinia Kola* Heckle fruit mesocarp. *Journal of Medicinal Plants Research*. 2020; 14,11:579–582.

[25]. Kim S K. (2018). Small intestine transit time in the normal small bowel study. *American Journal of Roentgenology,* 2018;104,3: 522–524

[26]. Malhi H, Gregory J G (2008). "Cellular and Molecular Mechanisms of Liver Injury. Gastroenterology 2008; 134 ,6:1641-1654.

[27]. Nosek T M (2016). "Section 6/6ch2/s6ch2_30". Essentials of Human Physiology.

[28]. Osemwegie O O, Nwonuma C O, Oluyori A P (2017). In vitro antimicrobial and in vivo lead

acetate poison abatement study of *Garcinia Kola* Heckel. *Journal of Taibah University for Science*.2017; 11,6: 883–894.

[29]. Owolabi M S, Ogundajo A, Yusuf K O., Lajide L, Villanueva H E, Tuten J A, and Setzer,W.N (2010).. Chemical Composition and Bioactivity of the Essential Oil of Chromolaena odorata from Nigeria. Records of Natural Products 72-78.

[30]. Roy A, Bhoumik D, Sahu R and Dwivedi J. (2014). "Medicinal plants used in liver protection—a review," Pharmaceutical and Biosciences Journal. 2014; 2,1:23–33.

[31]. Seidell J C (2000). "Obesity, insulin resistance and diabetes—a worldwide epidemic," British Journal of Nutrition, vol. 83, no. S1, pp. S5–S8.

[32]. Tortora Gerard (2014). Principles of Anatomy & Physiology. USA: Wiley. pp. 913. ISBN 978-1-118-34500-9. ..its length is about 3m in a living person and about 6.5m in a cadaver due to loss of smooth muscle tone after death.

[33]. Wyatt P G, Field M C, Horn D, Fairlamb A H, Michael A J F, David W G, Kevin R G, De Rycker, Leah S T. (2017). " Nature Reviews Microbiology 2017;15 ,4:217-231.

Cite of article: II Godwin, DA Kester, B Sylvanus, ON Prudence ON Elaye. Therapeutic and antagonist villi insurgency of garcinia kola on acetic acid induced erosive small intestinal ulcer of Wistar albino rat's model. Int. J. Med. Lab. Res. 2024;9,2:1-12. ***http://doi.org/10.35503/IJMLR.2024.9201***

CONFLICT OF INTEREST: Authors declared no conflict of interest
SOURCE OF FINANCIAL SUPPORT: Nil