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Antioxidant and Histomorphological Therapeutic Effect of Canarium Schweinfurthii Fruit Pulp Aqueous Extract on Albino Rats Ethanol Induced Stomach Ulcer

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Abstract: *Canarium schweinfurthii* derivatives exhibit multiple pharmacological activities and provide health benefits to various organs. Gastric ulcer is considered one of the most common digestive diseases in the present century. Inflammation and tissue alteration as a result of excess alcohol consumption are one of the key factors that disrupt gastric mucosal barrier. C. *schweinfurthii* fruit pulps extract, rich in bioactive components which may be beneficial to treatment of stomach ulceration. This study aimed to assess the therapeutic effect of aqueous extract of the *Canarium schweinfurthii*fruit pulp on the stomach against ethanol induced gastric ulceration using albino rat models. The study was carried out using thirty (30) albino rats aged 7- 10 weeks weighing between 150 and 185g grouped into 6 cages of 5 rats each. Group1 [Negative Control] received food and water while Group 2 [Positive control] received Food, water and 0.5ml ethanol. Group 3, 4 and 5 received food, water, 200, 400, 800mg/kg/bw of *Canarium schweinfurthii* fruit pulp with 0.5ml of ethanol respectively. Group 6 served as drug control group and received food, water with oral daily dose of Cimetidine 50mg/kg b.wt. The studied organs were harvested under anaesthesia (chloroform), ulceration index was observed and recorded. The excised organ tissue homogenate was prepared while others processed using histological technique. In the ulcerative index result, tested antioxidative mediators varied significantly across the groups. The negative control recorded the highest value whereas the cimetidine group had the lowest. These findings were also confirmed through a histopathological analysis of gastric tissue. In conclusion, *Canarium schweinfurthii* fruit pulp extract administration significantly reduced assessed parameters in dose-dependent manner, with high-dose group showing values closest to the cimetidine group providing a dose dependent curative effect.

Keywords: *Therapeutic Effect, Canarium Schweinfurthi, Stomach Ulcer, Ethanol, Cimetidine.*

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I. INTRODUCTION

The phytochemicals found in the various parts of the plants play a vital role in traditional medicine and are used in the treatment of various illnesses since pre-historic times (Josephine and Antoinette, 2019). Plant derived bioactive substances which played important roles in drug discovery, exert significant in anti-oxidant, anti-inflammatory, chemopreventive and anticancer activities in vitro and in vivo (Skrovankova et al, 2015).

Canarium schweinfurthii is a large tree, native to tropical Africa commonly known as African elemi, bush candle, pacific almond, Canarium nut and Java almond (The Green Institute, 2020) The plants are widely distributed in East, Central, and West Africa with various local names: *Abel* (Cameroon), *Aiele* (Ivory Coast), *Elemi* (Nigeria), *Bediwunua*, *Eyere* (Ghana), M*uwafu* (Uganda), *Mpafu* (East Africa). In Nigerian, it is locally identified as Ube Agba (Igbo), Atilis (Hausa) and origbo or agbababubu (Yoruba) (Frith et al, 2013; Dawang et al, 2016). The health benefits of *Canariums chweinfurthii* are numerous, so it is

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beneficial to virtually all the internal organs and the external parts of the human body (Okullo et al, 2014). The plant extracts are source of promising secondary metabolite, such as phenolic and terpenoid acids. It has been reported to possess several pharmacological activities including analgesic, antimicrobial and antioxidant, anti-diabetic and anti-inflammatory activities (Uzama et al, 2012).

Stomach ulcer is considered one of the most common digestive ailments in the present century, and its chronic lesions may occur in the stomach linings (Azhari et al, 2018). Among many other causes of ulcer are alcoholism, radiation therapy, stomach cancer, imbalanced homeostasis, frequent use of non steroid anti- inflammatory drugs (NSAIDs) and Helicobacter pylori infection. Open sores or erosion can develop on the lining of the stomach when the layer protecting the stomach lining from acid breaks down (Malik et al, 2023). Excessive ethanol consumption is considered one of the risk factors for gastric ulcers in humans (Søreide et al, 2015).

Several scientific research studies have been carried out on *Canarium schweinfurthii*, in order to determine its nutritional composition and prove to reveal the presence of chemical active compounds in all its parts (Nya *et al*, 2014). The leaves contain saponins, tannins, cardiac glycosides, steroids and flavonoids while the fruit contains oil, Phenolic compounds (Ngbede *et al*, 2008; Atawodi, 2010). Its bark contains triterpenes, steroids, saponins, lipids and glycosides, and *C. schweinfurthii* resin contains triterpenoic acids (Kouambou *et al*, 2007; Uzama *et al*, 2012). The seed contains tannins, balsams, cardiac glycosides, phenols and flavonoids (Okoli *et al*, 2015). Evidence of alkaloids, tannins, phenolic compounds, flavonoids, cardiac glycosides, saponins and steroids in the leaf and stem bark of *Canarium schweinfurthii* was also reported in previous studies (Koudou et al, 2005).

Study showed that its essential oil had antioxidant radical scavenging activities, and displayed the inhibition of lipid peroxidation, which suggest that *C. schweinfurthii* essential oil could serve as natural antioxidant agent (Tcheghebe *et al* 2016). However, *Canarium schewinfurthii* (African Elemi) has proven to be advantageous in the treatment of various ailments in laboratory animals and patients. Moreover, their absence of toxicity has been demonstrated by short- and long-term studies (Saeed *et al*, 2016).*Canarium schweinfurtii* fruits and fruits pulp oil contain phytochemicals that are capable of protecting irritations and injury to the gastric mucosa by covering the gastric mucosa (Lawal *et al*, 2024).

II. MATERIALS AND METHODS

➢ *Procurement of* Canarium *schewinfurthii*fruits

The fruit of *Canarium schweinfurthii was* purchased from Afor market in Iheapku ObolloAfor, in Udenu LGA, Enugu State, Nigeria in the beginning of January, 2025.

➢ *Preparation of Aqueous Fruit Extract*

The fruits of *Canarium schweinfurthii*were proper washed properly in a clean water and soaked in warm water of 40^0 C for 15minutes to soften pulp. They were extracted, air dried and grounded into powder using an electrical blender.100 grams of the powered pulp were immersed in 500ml of warm water and left overnight in a refrigerator at set at 4^0C. The cold aqueous pulp extract, was sieved first using muslin cloth then further filtrations using Whatman no 1 filter paper (125mm). The filtrate obtained was placed in an evaporator set at 45^0C. The jelly concentrate obtained was stored in a plastic container placed in a refrigerator. 1gram served as the original concentration used during the study.

➢ *Animal Procurement and Study*

Thirty [30] adult albino rats of mixed sex age 7 to 10 weeks weighing 120g to 185g were purchased and housed in the animal facility of the Department of Medical Laboratory Science Enugu State University of Science and Technology. The animals were housed in a well conducive and ventilated laboratory cages in groups of five (5), with soft wood shavings as bedding. They were acclimatized for two weeks and allowed to have free access to food and clean water. The animals were maintained in a clean disease-free environment according to the ethics guidelines of the institution [ESUT/AREC/0225/47/201503017282 MLS]

➢ *Drugs and Chemicals*

Ethanol 99.7-100% v/v GPR re-packaged in Nigeria by NAAFCO scientific supplies LTD Lagos, Nigeria was purchased from Ogbete Enugu metropolis of Enugu state while Cimetidine tablet B.P 400 mg manufactured by Krishat Pharmaceutical Industry Ltd Ibadan, Nigeria was purchased at Annox pharmaceutical shop in GRA Enugu, Enugu State, Nigeria.

➢ *Experimental Design and Procedures*

Aqueous extract of *Canarium schweinfurthii fruit pulp* was prepared and administered as single oral daily drug for a week after intraperitoneal in gestation of 0.5mls of 100% ethanol before sacrificing the animals. Cimetidine 50mg/ kg b.wt was used as the Standard control drug.

Group1 [Negative Control] received Food and water, group2 [Positive control] received Food, water and 0.5 mls ethanol, group3, 4 and 5 received food, water, 200, 400, 800mg/kg/ b.wt of *C. schweinfurthii fruit* extract with 0.5mls of ethanol respectively group 6 served as drug control group and received food, water and Cimetidine 50mg/ kg b.wt.

➢ *Sample Collection*

On the eight days,after last doses of *C. schweinfurthii* extract were administered, the rats were sacrificed under chloroform anesthesia and the organs of the rat were identified and carefully excised out. The organs were first washed in physiological saline to remove undigested food particles. Ulceration patches was examined using a hand lens. Tissue homogenate samples were prepared using phosphophate buffer, other harvested organs were fixed,

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processed using the normal tissue processing methods and stained using Hematoxylin and Eosin Staining procedure.

➢ *Macroscopic Study/ Assessment (Ulcer Index)*

The organs (colon) were visible studied for injuries such as thickening of the organ (colon), shortening of the colon, hyperemia, erosion and necrosis.

Ulcer scores were recorded from 0-100% based on increased severity (Ballester*et al.*, 2007).

➢ *Determination of Antioxidative Mediators Parameters*

Tissue homogenate samples prepared were used to determine Glutathione (GSH) Malondialdehyde (MDA), Catalase (CAT) and Superoxide dismutase (SOD) activity

➢ *Histopathological Analysis of the Gastric Tissue*

The organs harvested for histopathological examination were processed and stained using hematoxylin and eosin techniques.

➢ *Statistical Analysis*

The data generated from the experiment was statistically analyzed using Dunnet multiple comparison test and Tukey's post-hoc test. Values are expressed as Mean ± SD and $p<0.05$ were considered statistically significant.

III. RESULT AND DISCUSSION

➢ *Ulcer Curative Index*

Table 1 Stomach Ulcer Indices and Ulcer Index for the Animals in the Various Groups. Values are Presented as Mean ± SEM.

	Ulcer Index	**Ulcer curative Index (%)**
Ulcer control	2.70 ± 0.06	-
Cimetidine	0.47 ± 0.03**	82.59
Low dose	1.70 ± 0.06**	37.04
Medium dose	1.37 ± 0.09**	49.26
High dose	1.00 ± 0.12**	62.96

** Represents $P < 0.001$ Compared to the Ulcer Control Group Using the Dunnet Multiple Comparison Test.

The curative index shows that as the low doses recorded 37.04%, there is significant increase in medium doses to 49.26% and then high doses to 62.96% indicating a dose curative index percentage increase.

➢ *Assessment of Oxidative Stress Parameters of the Stomach*

Table 2 Effect of Pre-Treatment with Aqueous Extract of *C. schweinfurthii* Pulp on Reduced Glutathione (GSH) Levels in Ethanol-Induced Gastric Ulcer in Albino Rats

Group	**GSH (mg/dl)**
Normal control	7.32 ± 0.11^{a}
Ulcer control	3.31 ± 0.13^{b}
Cimetidine	2.53 ± 1.02^{c}
Low dose	2.42 ± 0.17^{c}
Medium dose	3.24 ± 0.67^{b}
High dose	3.62 ± 0.25^{b}
F-value	**110.3758**
P-value	**<0.0001***

Values are Expressed as Mean ± SD (n = 5). Values Bearing Different Superscript Letters Differ Significantly at $p < 0.05$ Using Tukey's Post-Hoc Test.

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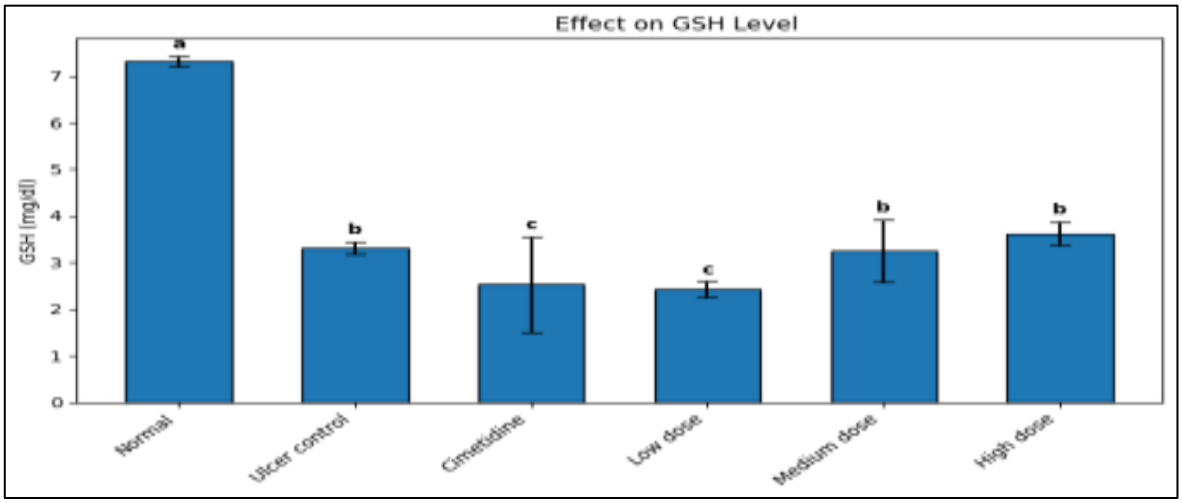

Fig 1 Effect of Aqueous Extract of *C. schweinfurthii* Pulp on GSH Levels in Ethanol-Induced Gastric Ulcer in Albino Rats. *Bars Represent Mean ± SD (n = 5). Bars with Different Superscript Letters Differ Significantly at p < 0.05 Using Tukey's Post-Hoc Multiple Comparison Test*

- *Description of Table 1 and Figure 1*

As presented above ethanol administration caused a marked reduction in GSH concentration in the ulcer control group (3.31 ± 0.13 mg/dl) when compared with the normal control group (7.32 ± 0.11 mg/dl), indicating depletion of endogenous antioxidant defense mechanisms following gastric ulcer induction. Treatment with aqueous extract of *C. schweinfurthii* pulp produced varying effects on GSH levels across the experimental groups. The high-dose group recorded a relatively higher GSH concentration (3.62 ± 0.25 mg/dl) compared with the ulcer control and low-dose groups, suggesting improved antioxidant activity at increased extract concentration. Statistical analysis revealed a significant difference among the groups ($F = 110.38$, $p < 0.05$).

Table 3 Effect of Pre-Treatment with Aqueous Extract of *C. schweinfurthii* Pulp on Malondialdehyde (MDA) Levels in Ethanol-Induced Gastric Ulcer in Albino Rats

Group	**MDA (mg/dl)**
Normal control	1.02 ± 0.12^{ab}
Ulcer control	1.62 ± 0.13^{c}
Cimetidine	1.14 ± 0.10^{ab}
Low dose	1.02 ± 1.10^{ab}
Medium dose	1.09 ± 0.05^{ab}
High dose	0.53 ± 0.22^{a}
F-value	**3.9763**
P-value	**0.0087***

Values are Expressed as Mean ± SD (n = 5). Values Bearing Different Superscript Letters Differ Significantly at p < 0.05 Using Tukey's Post-Hoc Test.

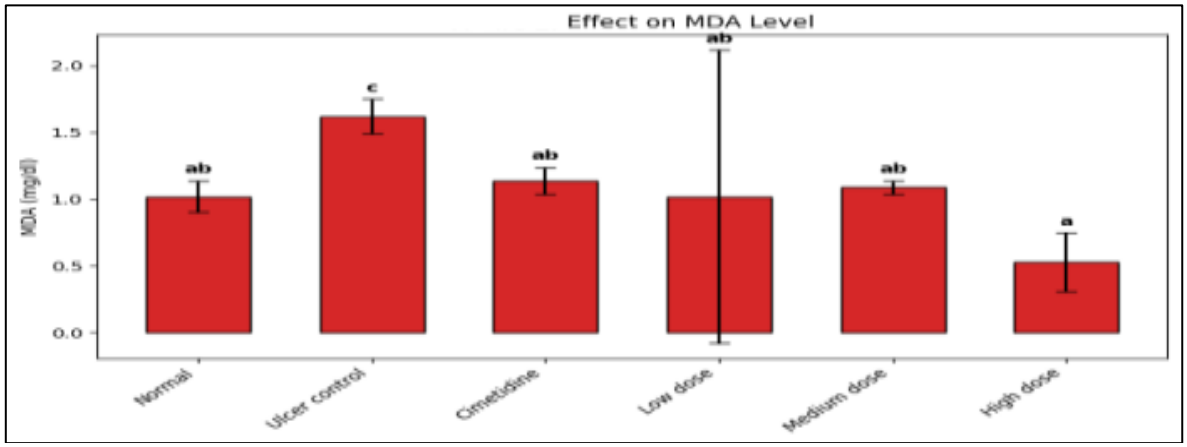

Fig 2 Effect of Aqueous Extract of C. *schweinfurthii* Pulp on MDA Levels in Ethanol-Induced Gastric Ulcer in Albino Rats Bars Represent Mean ± SD (n = 5). Bars with Different Superscript Letters Differ Significantly at p < 0.05 Using Tukey's Post-Hoc Multiple Comparison Test.

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- *Description of Table 2 and Figure 2*

As shown in Table 2 and Figure 2, the ulcer control group recorded the highest MDA concentration (1.62 ± 0.13 mg/dl) compared with the normal control group (1.02 ± 0.12 mg/dl), indicating increased lipid peroxidation and oxidative stress following ethanol-induced gastric injury. Pre-treatment with aqueous extract of *C. schweinfurthii* pulp reduced MDA levels across the treatment groups. The high-dose group showed the lowest MDA concentration (0.53 ± 0.22 mg/dl), suggesting stronger inhibitory activity against lipid peroxidation at higher extract concentration. Statistical analysis revealed a significant difference among the groups ($F = 3.98$, $p < 0.05$).

Table 4 Effect of Pre-Treatment with Aqueous Extract of *C. schweinfurthii* Pulp on Catalase (CAT) Activity in Ethanol-Induced Gastric Ulcer in Albino Rats

Group	CAT (u/mg)
Normal control	7.15 ± 3.85^{a}
Ulcer control	1.80 ± 1.23^{b}
Cimetidine	4.72 ± 0.37^{a}
Low dose	3.42 ± 1.10^{ab}
Medium dose	4.40 ± 0.23^{a}
High dose	5.03 ± 0.58^{a}
F-value	**7.3122**
P-value	**0.0003***

Values are Expressed as Mean ± SD (n = 5). Values Bearing Different Superscript Letters Differ Significantly at $p < 0.05$ Using Tukey's Post-Hoc Test.

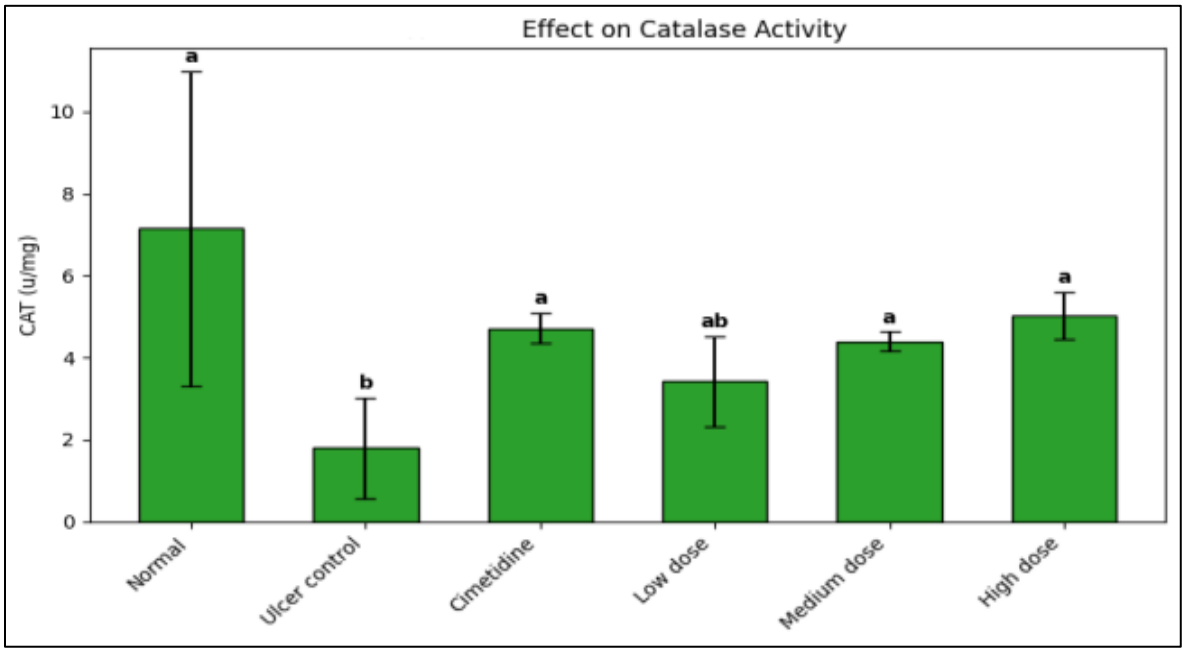

Fig 3 Effect of Aqueous Extract of C. *schweinfurthii* Pulp on Catalase (CAT) Activity in Ethanol-Induced Gastric Ulcer in Albino Rats

Bars Represent Mean ± SD (n = 5). Bars with Different Superscript Letters Differ Significantly at $p < 0.05$ Using Tukey's Post-Hoc Multiple Comparison Test.

- *Description of Table 3 and Figure 3*

As presented in Table 3 and Figure 3, ethanol administration caused a reduction in catalase activity in the ulcer control group (1.80 ± 1.23 u/mg) when compared with the normal control group (7.15 ± 3.85 u/mg), indicating impairment of antioxidant defense mechanisms following gastric ulcer induction. Treatment with aqueous extract of *C. schweinfurthii* pulp increased CAT activity across the treatment groups. The high-dose group recorded a relatively higher catalase activity (5.03 ± 0.58 u/mg), comparable to the cimetidine-treated group, suggesting enhanced antioxidant protection at increased extract concentration. Statistical analysis revealed a significant difference among the groups ($F = 7.31$, $p < 0.05$).

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Table 4 Effect of Pre-Treatment with Aqueous Extract of *C. schweinfurthii* Pulp on Superoxide Dismutase (SOD) Activity in Ethanol-Induced Gastric Ulcer in Albino Rats

Group	SOD (u/mg)
Normal control	1.25 ± 1.03^{a}
Ulcer control	1.98 ± 0.01^{a}
Cimetidine	5.20 ± 0.15^{b}
Low dose	3.30 ± 1.14^{b}
Medium dose	5.32 ± 0.43^{b}
High dose	5.38 ± 1.52^{b}
F-value	**17.95**
P-value	**0.0001***

Values are Expressed as Mean ± SD (n = 5). Values Bearing Different Superscript Letters Differ Significantly at $p < 0.05$ Using Tukey's Post-Hoc Test.

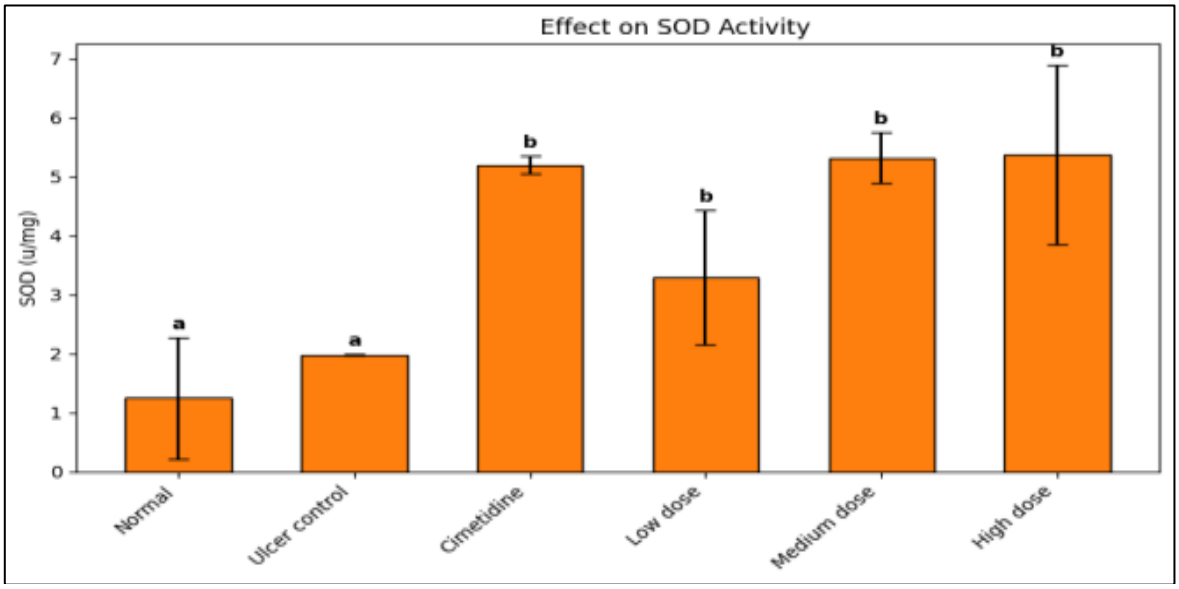

Fig 4 Effect of Aqueous Extract of *C. schweinfurthii* Pulp on Superoxide Dismutase (SOD) Activity in Ethanol-Induced Gastric Ulcer in Albino Rats
Bars Represent Mean ± SD (n = 5). Bars with Different Superscript Letters Differ Significantly at $p < 0.05$ Using Tukey's Post-Hoc Multiple Comparison Test

- *Description of Table 4 and Figure 4*

As shown in Table 4 and Figure 4, SOD activity was lower in the normal control and ulcer control groups when compared with the treatment groups. Administration of aqueous extract of *C. schweinfurthii* pulp increased SOD activity across the treated groups, with the high-dose group recording the highest value (5.38 ± 1.52 u/mg). The cimetidine-treated and medium-dose groups also showed elevated SOD activity relative to the ulcer control group, suggesting enhanced antioxidant defense against ethanol-induced oxidative stress. Statistical analysis revealed a significant difference among the groups ($F = 8.734$, $p = < 0.05$). Groups bearing different superscript letters differ significantly at $p < 0.05$.

Table 5 Effect of Treatment with Aqueous Extract of *C. Schweinfurthii* Pulp on Oxidative Stress Biomarkers in Ethanol-Induced Gastric Ulcer in Albino Rats

Group	GSH (mg/dl)	MDA (mg/dl)	CAT (u/mg)	SOD (u/mg)
Normal control	7.32 ± 0.11^{a}	1.02 ± 0.12^{ab}	7.15 ± 3.85^{a}	1.25 ± 1.03^{a}
Ulcer control	3.31 ± 0.13^{b}	1.62 ± 0.13^{c}	1.80 ± 1.23^{b}	1.98 ± 0.01^{a}
Cimetidine	2.53 ± 1.02^{c}	1.14 ± 0.10^{ab}	4.72 ± 0.37^{a}	5.20 ± 0.15^{b}
Low dose	2.42 ± 0.17^{c}	1.02 ± 1.10^{ab}	3.42 ± 1.10^{ab}	3.30 ± 1.14^{b}
Medium dose	3.24 ± 0.67^{b}	1.09 ± 0.05^{ab}	4.40 ± 0.23^{a}	5.32 ± 0.43^{b}
High dose	3.62 ± 0.25^{b}	0.53 ± 0.22^{a}	5.03 ± 0.58^{a}	5.38 ± 1.52^{b}
F-value	**110.3758**	**3.9763**	**7.3122**	**17.9547**
P-value	**0.0001***	**0.0087***	**0.0003***	**0.0001***

Values are Expressed as Mean ± SD (n = 5). Values Bearing Different Superscript Letters within the Same Column Differ Significantly at $p < 0.05$ Using Tukey's Post-Hoc Test.

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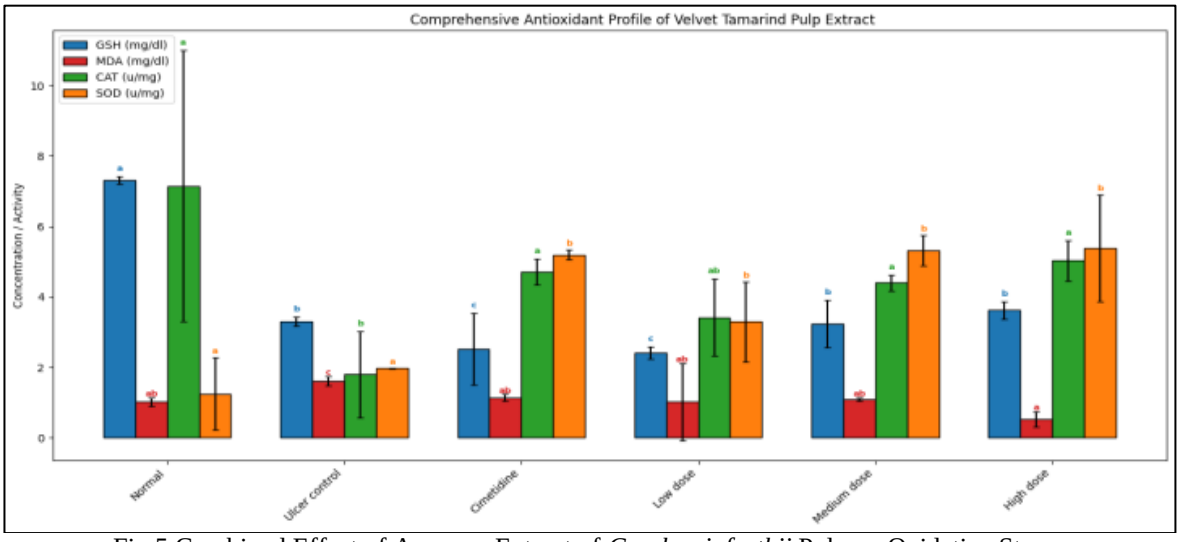

Fig 5 Combined Effect of Aqueous Extract of *C. schweinfurthii* Pulp on Oxidative Stress Biomarkers in Ethanol-Induced Gastric Ulcer in Albino Rats
Bars Represent Mean ± SD (n = 5). Bars Bearing Different Superscript Letters within Each Parameter Differ Significantly at $p < 0.05$ Using Tukey's Post-Hoc Multiple Comparison Test.

- *Description of Table 5 and Figure 5*

As presented in Table 5 and Figure 5, ethanol-induced gastric ulcer caused alterations in oxidative stress biomarkers across the experimental groups. The ulcer control group showed reduced GSH, CAT, and SOD activities with increased MDA concentration when compared with the normal control group, indicating oxidative damage and impairment of endogenous antioxidant defense systems. Treatment with aqueous extract of *C. schweinfurthii* pulp improved antioxidant status by increasing GSH, CAT, and SOD activities while reducing MDA levels across the treatment groups. The high-dose group demonstrated the most pronounced antioxidant effect, evidenced by higher antioxidant enzyme activities and lower lipid peroxidation levels relative to the ulcer control group. Statistical analysis showed significant differences among the groups for all evaluated parameters ($p < 0.05$).

➢ *Stomach Photomacrographs Showing the Inner Walls of the Gastric Mucosa from the Different Groups*

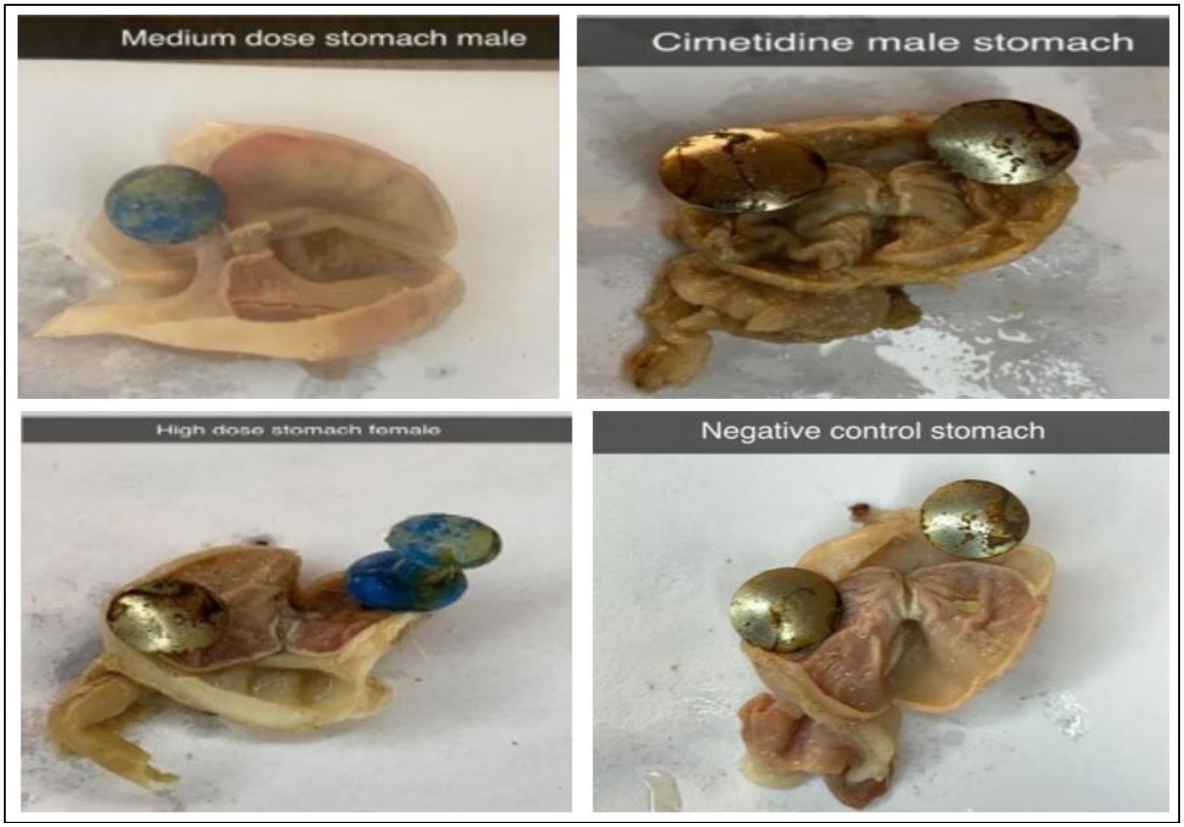

Fig 6 Stomach Photomacrographs Showing the Inner Walls of the Gastric Mucosa from the Different Groups

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➢ *Histological Findings*

The Results following the administration of *Canarium schweinfurthii* aqueous extract consistently for one week shows no adverse effect on the stomach and small intestine of the doses administered on the ethanol induced ulcer to the stomach. The groups treated with *Canarium schweinfurthii* aqueous extract showed significant healing and protective effects when monitored and captured in the photomicrographs below;

➢ *Photo-Micrographs of the Stomach Section*

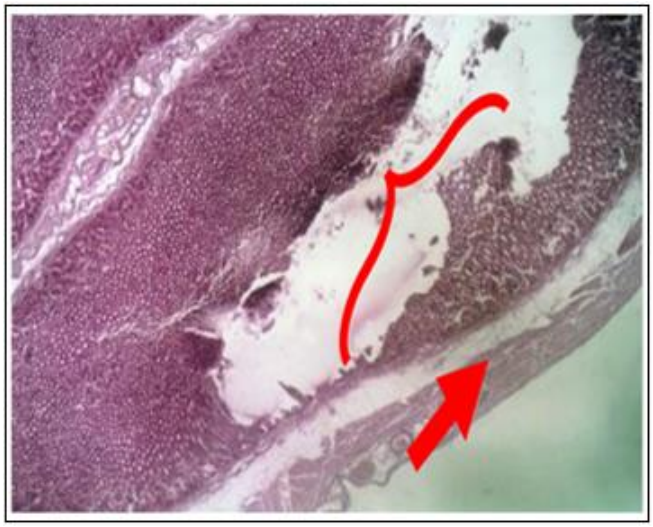

Plate One: Positive Control Group

The representative micrograph of the stomach section in the positive control group shows the gastric epithelia was eroded (Bracket).The sub-mucosa blood vessels are engorged (arrow heads). Stain: Haematoxylin and Eosin. Magnification: X 400

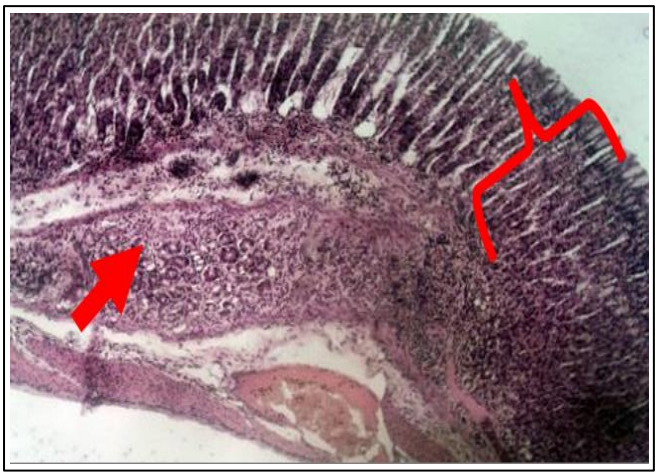

Plate Two: Cimetidine Standard Drug

The representative micrograph of the stomach sections in the cimetidine standard drug control group shows normal gastric epithelia (bracket). There is mild cellular infiltration in the sub-mucosa (arrow heads). Stain: Haematoxylin and Eosin. Magnification: X 400.

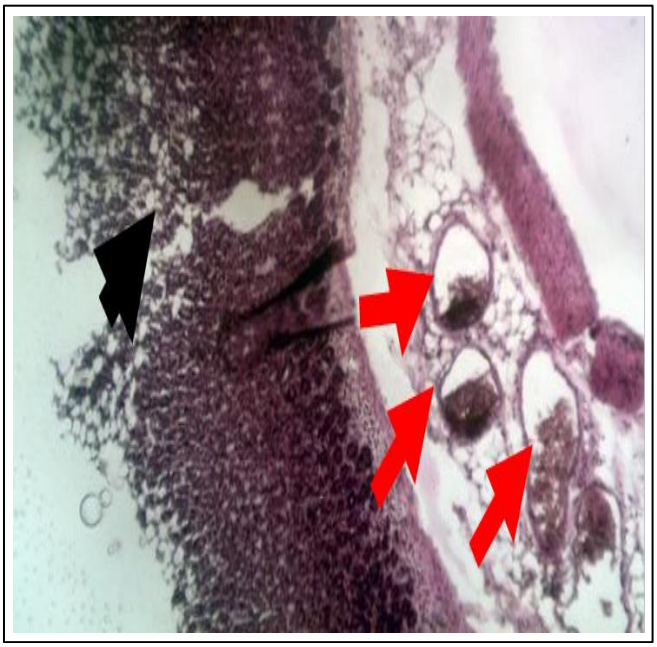

Plate Three: Low Dose Group

The representative micrograph of the stomach of an animal in the low dose group shows a break in the gastric epithelia (arrow head), the blood vessels appear dilated and engorged (arrows). Stain: Haematoxylin and Eosin. Magnification: X 400.

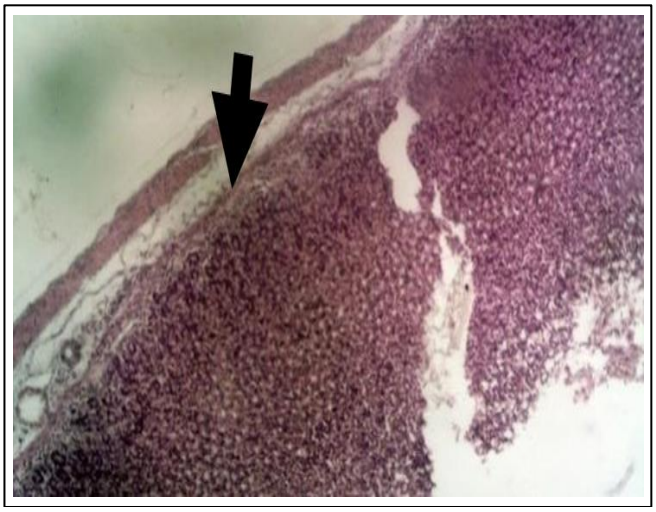

Plate Four: Medium Dose Group

The representative micrograph of the stomach of an animal in the medium dose group shows a break in the gastric epithelia (arrow). Stain: Haematoxylin and Eosin. Magnification: X 400.

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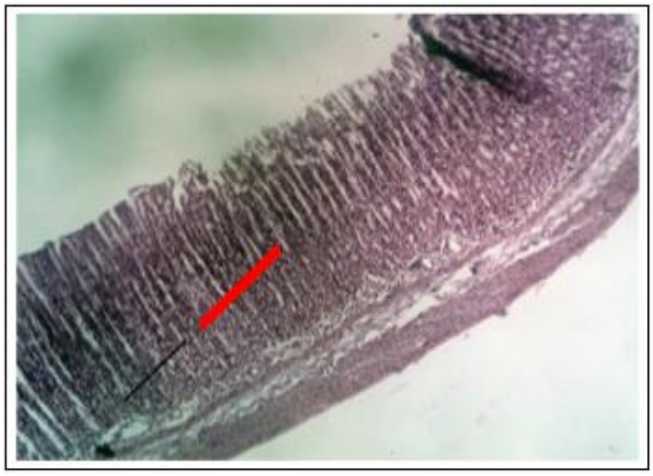

Plate Five: High Dose Group

The representative micrograph of the stomach section in the high dose group shows normal histological features; Gastric epithelia – E; gastric glands – G; muscularis mucosa – MM; sub-mucosa – S. Stain: Haematoxylin and Eosin. Magnification: X 400.

IV. DISCUSSION AND CONCLUSION

Gastric ulcers in humans and cost of some available synthetic drugs with side effects can be alleviated by use of natural products, thus can represents an important alternative for many [Saeed et al, 2016]. The percentage curative index shows significant as the doses increase from low to medium and then high dose recording values close to normal control group (Table 1). Different superscripts within the same column indicate significant difference at $P< 0.001$ (Table 2). This curative may be related to the antioxidant properties of *Canarium schewinfurthii* by activating some enzymatic antioxidant mechanisms and attenuating the inflammatory response and improving defenses against the erosive lesion that characterize the development of gastric ulcers produced by ethanol.

In oxidative stress parameters, Bar Chart 1 showed mean ± SD of reduced glutathione (GSH). Ethanol induced groups had a sharp decline (c). High dose extract administration partially restored GSH (b), while the normal group remained superior (a). Malondialdehyde level (Chart 2), a lipid peroxidation marker had its peaks in the ulcer control (b). The high dose of the extract lowers MDA significantly below normal (a) thus demonstrating strong antioxidant protection. In Chart 3, Catalase activity is severely depressed by ethanol group (b). Medium and high doses of the extract, as well as cimetidine treated groups, bring activity back into the range of the normal control (a,b). Superoxide dismutase activity (Chart 4) is boosted by cimetidine and the extract's higher doses to levels far exceeding normal (c), while the low dose produces a moderate increase (b).

In histopathological studies, the positive control group (Plate 1) shows significant gastric epithelia erosion with the sub-mucosa blood vessels engorged while the stomach section in the high drug extract dose group shows normal histological features. The current investigation evaluated the antiulcerogenic activity of *Canarium schewinfurthii* on gastric ulcer model [Lawal et al, 2024]. There is also significant effect of *Canarium schewinfurthii* in protection against histopathological damage. This attribute may be evidence of stimulating cell growth and viability, both in human keratinocytes and in a rat model [Tcheghebe et al, 2016].

Moreover, the histopathological changes triggered by ethanol were significantly diminished. The gastro curative effect of cimetidine when compared to *Canarium schewinfurthii* pulp extract administration has a significant healing effect that is similar within the stomach lining of the *albino* rats. *Canarium schewinfurthii* provided curative effect on ethanol-induced ulcers; the findings of the tested parameters finding were also confirmed through a histopathological analysis of gastric tissue.

In conclusion, the current results suggest a significant effect of *Canarium schewinfurthii* pulp on ethanol-induced gastric ulcer damage has shown therapeutic potentials among the tested parameters.

RECOMMENDATION

Canarium schewinfurthii has shown therapeutic potential, however, pharmaceutical institutes should consider its ethnomedicinal contents. Moreover, further detailed studies are needed to clarify if increase in extract doses can provide alternative treatment.

- *Consent*

  It is not applicable.

- *Authors' Contributions:*

  This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

- *Ethical Approval*

  Animal Ethical committee provided ethical approval for this research work.

- *Competing Interest*

  Authors have declared that no competing interests exist

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