

## Study of the Effect of Aqueous Extract of Kolanut (*Cola nitida*) on Gastric Acid Secretion and Ulcer in White Wistar Rats

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**Abstract:** Generally, increase in the acid output in the body causes ulcer especially peptic ulcer. Duodenal ulcer has worldwide incidence but its incidence varies geographically and even in some country regionally. Duodenal and peptic ulcer diseases are problems of the gastrointestinal tract. Nowadays, drugs are expensive and have many side effects during treatment of any disorders. In this study the aqueous extract of *cola nitida* was administered to 30 Wistar rats in two phases (gastric acid secretion phase and ulceration phase). The ulcer score and gastric acidity were determined. The highest acid output was obtained with a dose of 7.5 mg/mL and the lowest with a dose of 5.0 mg/mL. However no ulceration was seen with the same doses of *cola nitida*, this may mean that formation of ulcerations may not be only due to increase acidity or probably the doses used was not enough to cause ulceration. Comparing this with control group gave a significant difference for the gastric acid secretion group, though there was no ulceration formed with the same dose. The result of this study showed that *cola nitida* induces gastric secretion

**Key words:** Caffeine, *cola nitida*, duodenal, gastric secretion, peptic ulcer, xanthine

### INTRODUCTION

*Cola nitida* has been used in folk medicine as an aphrodisiac, an appetite suppressant, to treat morning sickness, migraine headache, and indigestion (Esimone *et al.*, 2007). It has also been applied directly to the skin to treat wounds and inflammation (Newall *et al.*, 1996). The tree's bitter twig has been used as well, to clean the teeth and gums (Esimone *et al.*, 2007). In Africa, duodenal and peptic ulcer is common among southern part of Africa, Burundi, Rwanda, and eastern Zaire, high land of Ethiopia, central Sudan and east Africa especially around Kilimanjaro Mountain. However, in Nigeria there is no record on the incidence of peptic ulcer, but seroprevalence of helicobacter pylori in patients with gastric and peptic ulcers was carried out in the western part of Nigeria. Of the 92% patients screened 41% represented with peptic ulcer disease. The cola nut tree is native to West Africa. Cola nuts are obtained from cola trees. *Cola nitida* belongs to the genus *Cola* and family Sterculiaceae. They are commonly used to counteract hunger and thirst, in some cases it is used to control vomiting in pregnant women also it is used as a principal stimulant to keep awake and withstand fatigue by students, drivers, and other menial workers (Haustein, 1971; Chukwu *et al.*, 2006). *Cola nitida* is not advised for individuals with

stomach ulcers due both to its caffeine and its tannin content (Ibu *et al.*, 1986, Newall *et al.*, 1996). The colacuminata is more popular in the Igbo and Igedde tribes of eastern and middle regions of Nigeria, while the *cola nitida* is more common in the northern part of the country among the Hausa Fulani (Ibu *et al.*, 1986). Cola trees are best known for their seeds or nuts which are rich in caffeine. Thymolepte, antidepressant and antidiarrheal effects have been observed with its uses. Since the caffeine content of cola nut induces gastric acid secretion an investigation of the effect of colanitida on gastric acid secretions will be of great interest since very few literatures has been reported in this area.

### MATERIALS AND METHODS

**Plant material:** Fresh *Cola nitida* seeds procured in a local market in Zaria Nigeria in the month of June 2006. It was then taken to herbarium section of the department of Biological Sciences Ahmadu Bello University Zaria, where it was identified by U.S. Galah. A voucher (V/n 3260) specimen was deposited for future reference.

**Extraction of plant material:** The fresh seeds of the plant were cut into pieces and dried; the dried seeds were ground into powder. One hundred grams (100 g) portion

of the powdered seeds was extracted by macerating with distilled water for 24 h and then boiled for 15 min, allowed to cool and filtered. The extract was evaporated to dryness at a temperature of 40-45°C. A yield of 50g was obtained and kept at 4°C prior to use.

**Animal material:** A total of 30 Wister rats were obtained from the animal house of the department of Biological Sciences, Federal College of Education Zaria. The animals were of both sexes weighing between 150-200 g. They were kept in the animal house in the Department of Human Physiology Ahmadu Bello University Zaria.

**Phytochemical procedure:** The preliminary phytochemical screening of aqueous extract of Kolanut (*cola nitida*) was carried out in order to ascertain the presence of its constituents by utilizing standard conventional protocols (Trease and Evans, 1989).

**Gastric secretion:** The method described by (Shay *et al.*, 1945). Was adopted, 15 Wistar rats were used; they were divided into three groups of five rats each. Group 1 serves as control, group 2 received 5 mg/mL of the extract and group 3 received 7.5 mg/mL of the extract. The extract was administered orally to the animals according to their body weight. Pyloric ligation was done one hour after extract administration (Shay *et al.*, 1945). Animals were anesthetized using chloroform. The pyloric ligation was done through a midline incision of the abdomen and later sutured back using thread and needle. Four hours later, the animals were sacrificed by cervical dislocation. The stomach was then removed and the gastric content carefully collected into test-tubes and was then centrifuged and studied for juice parameters like volume, titrable acidity and acid output.

**Gastric ulceration group:** The method described by (Shay *et al.*, 1945). Was adopted, 15 wistar rats were used; they were divided into three groups of five rats each. Group 1 control, group 2 received 5 mg/mL of the extract and group 3 received 7.5 mg/mL of the extract. The extract was administered orally to the animals

according to their body weight. Pyloric ligation was done one hour after extract administration (Shay *et al.*, 1945). Animals were anesthetized using chloroform. The pyloric ligation was done through a midline incision of the abdomen and later sutured back using thread and needle. Four hours later, the animals were sacrificed by cervical dislocation. The abdomen was cut open through a midline incision and the stomach was carefully removed and washed immediately with distilled water. The stomach was open along the greater curvature, washed with distilled water and spread on a filter paper. A 2x hand lens was used to locate and score the lesions according to the method described by (Oharra *et al.*, 1995). The severity of mucosal damage was graded as follows:

Scoring	Ulcer grading
No lesion	0
Hemorrhagic lesion < 5 mm	1
Hemorrhagic lesions >5 mm or small linear ulcers	2
Many small linear ulcers <2 mm or a single linear Ulcer (2 mm)	3
Multiple linear ulcer of marked size	4

Ulcer index was calculated using the formulae:

$$\text{Ulcer index} = \frac{\text{No. of rats in each group} \times \text{number of grades}}{\text{No. of rats in the group}}$$

$$\text{Ulcer index} = \frac{\text{No. of grades of ulcer}}{\text{Total number of rats}} \times 100$$

**Statistical analysis:** Results were expressed as mean±SEM and the difference between mean values was analyzed using one-way analysis of variance (ANOVA) followed by Duncan's multiple range post test. Values of p<0.05 were considered significant (Duncan *et al.*, 1977).

## RESULTS AND DISCUSSION

**Phytochemical analysis:** The phytochemical screening revealed the constituents of *Cola nitida* to include theobromine, Methylxanthines, theopilline, d-catechin, l-epicatechin, kolatin, kolanin, glucose, starch, fatty matter, tannins, anthocyanin pigment, betaine and protein (Table 1 and 2).

Table 1: Volume of gastric juice and acid output

Groups	Dose (mg/mL)	Mean volume of Gastric Juice	Mean titrable acid output
1	Normal saline	1.98±0.36	6.00±0.90
2	5	1.56±0.17*	11.00±1.87*
3	7.5	2.94±0.09*	22.00±1.08*

Values are given as mean ± SEM; experimental groups were compared with control. Values are statistically significant at \* = p<0.05

Table 2: Extent of gastric lesions

Groups	Extent of gastric lesions					Ulcer incidence	Ulcer index
	0	1	2	3	4		
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0

The result revealed ulcer lesion of zero throughout the groups. This means that there is no effect (ulceration)

Our investigation revealed that, *cola nitida* increases gastric acid secretion. The highest output was observed with the dose of 7.5 mg/mL and the lowest with 5.0 mg/mL. It can be deduced that the increase in gastric acid secretion is dose dependent. However no ulceration was seen with the same doses of *cola nitida*, this may mean that formation of ulcerations may not be only due to increase acidity or probably the doses used was not enough to cause ulceration. *Methylxanthines* which are active constituents of *colanitida* generally have been reported to potentiate the actions of various secretagogues which include; histamine, cholinergic agonist, pentagastrin and gastrin. The use of coffee and cola beverages has been implicated in the pathogenesis and management of peptic ulcer. The administration of caffeine to animals caused pathological changes in the gastrointestinal track and ulcer formation (Maredine, 1975). These observations conform to earlier reports that kola nuts have fat-burning properties and stimulate the secretion of gastric juices (Esimone *et al.*, 2007; Ibu *et al.*, 1986). The gastric juices, so indiscriminately discharged, are capable of digesting the surface epithelium if not put under control (Ibu *et al.*, 1986). The exact mechanism by which *cola nitida* induces gastric acid secretion is yet to be discovered. However, there is increasing evidence that cyclic AMP is implicated in gastric acid secretion caused by alkaloids. The first reported acid stimulatory effects in rats were found after administration of exogenous cyclic AMP, by adding it to the perfusions medium (Ramwell *et al.*, 1968). It has also been shown that during pentagastrin stimulated acid secretion, tissue cyclic AMP level increased significantly. Exogenous supplied cyclic AMP stimulated hydrogen and chloride transport as did methylxanthines, theophylline being more effective than caffeine lead to an increase of the mucosal content of cyclic AMP, which preceded the secretory response (Harris *et al.*, 1969). Phosphodiesterase metabolises cyclic AMP to 5'AMP, so it is either the alkaloids that causes the synthesis of the active adenylate cyclase enzyme which catalyses the formation of cyclic AMP from ATP or they inhibit the metabolizing enzyme, phosphodiesterase.

### CONCLUSION

It can be said that, *Colanitida* increases gastric acid secretion in wistar rats. The indication of gastric acid secretion of *cola nitida* could be entirely due to the presence of xanthine or it may involve gastric secretagogues in cola yet to be discovered.

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