

Aqueous fruit pulp of *Dalium guineense* protects against gastric acid secretion and decrease pepsin activity in albino wistar rats

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ABSTRACT

The effect of aqueous fruit pulp of Dalium guineense on gastric acid secretion and pepsin activity was investigated. Thirty male albino Wistar rats weighing between 170-200g were used. The rats were randomly selected into three groups containing 10 rats each. Group 1 was the control group fed on normal rat chow. Group 2 received 300mg/kg extract orally. Group 3 received 500mg/kg extract orally. At the end of 6 weeks, gastric acid output was measured using the continuous perfusion method of rat stomach. Animals were placed under anesthesia at the rate of 1ml/min. Gastric acid secretion and pepsin activity were determined according to standard procedures. There was a significant ($p < 0.05$) decrease in gastric acid secretion and pepsin activity in the treated groups. The results suggest that Dalium guineense can protect against gastric acid secretion and decreases pepsin activity in the rat.

Key words: *Dalium guineense*, Pepsin activity, cytoprotection, gastric acid

INTRODUCTION

Abnormally raised gastric acid level with a concomitant reduced level of bicarbonate and mucus secretion may be a leading cause of mucosal excoriation and development of peptic ulcer. Many approaches have been adopted towards managing the recent scourge of gastrointestinal insults including the use of medicinal plants in traditional medicine. Research has shown that the aqueous and ethanolic extract of the stem and leaf of *Dalium guineense* play a major role in cytoprotection and anti-gastric acid secretion [1]. This plant, velvet tamarind is an indigenous tropical forest fruit tree that belongs to the family leguminosae and is widely used amongst countries in West Africa particularly in Guinea Bissau, Senegal and Sierra Leone where it is known commonly as 'Veludo'.

In Nigeria, it is called by different names depending on the region where it is found. In Igbo it is called Icheku, in Yoruba it is known as Awin, while in Yakurr language in Cross River State, it is called Okanagbengbenwen.

Interestingly, the phytochemical component reported to be present in the plant stem, bark and leaves include tannins, alkaloids, saponins, flavonoid, steroids and cardiac glycosides [2,3]. Flavanoid present in plants have been confirmed to have anti-ulcerogenic property and is said to be cytoprotective [4,5]. Other identified components of

the plant particularly the fruit pulp include non- starch polysaccharides or dietary fiber such as gums, hemicelluloses, mucilage and pectin. It also contains ascorbic acid, minerals such as copper, potassium, calcium, iron, selenium, zinc and magnesium, vitamins like vitamin-A, folic acid, riboflavin, niacin and vitamin C, tartaric acid (an anti-oxidant), carbohydrates in the form of soluble sugars, cellulose, iron and lipids [6,7]. All these natural endowment has provided the plant with therapeutic property.

This present study was aimed at investigating the anti-secretory and anti-pepsin effect of the aqueous fruit pulp extract of *Dalium guineense* on in the gastrointestinal tract of albino Wistar rats.

MATERIALS AND METHODS

PREPARATION OF AQUEOUS EXTRACT OF FRUIT PULP

The black hard fruits of *Dalium guineense* was collected and the coats broken to expose the pulp of the fruit. The pink soft pulp was further separated from the dark colored hard seeds after which it was dried at room temperature for one week and then blended to powder. Animals received 300mg/kg and 500mg/kg body weight respectively of the mixture. The blended powder was stored in the refrigerator at 4°C.

EXPERIMENTAL DESIGN

Thirty male albino Wistar rats weighing 170-200g were obtained from the department of Physiology, Cross River University of Technology, Calabar, Okuku Campus. Three groups of rats containing 10 each were randomly selected and used for the study. Feed and water was provided ad libitum. Group 1 was the control fed on normal feed. Group two was fed with 300mg/kg. Group three received 500mg/kg of extract. At the end of (six) 6weeks, gastric acid output was measured by continuous perfusion of rats stomach under anaesthesia with normal saline at the rate of 1ml/min. Basal gastric acid secretion and maximal (Histamine -induced) and pepsin activity were determined according to standard procedures.

Preparation of animals for collection of gastric acid

Animals were fasted for 12-18 hours so that they could be free of faecal matter in the stomach. Fasted animals were anaesthetized intra-peritoneally using 25% urethane at a dose of 5ml per Kg body weight of the animal. The animals were laid on a dissecting board, and the trachea was incised along the tracheal rings and cannulated to allow for proper aeration. Incision was also made along the the *linea alba* to expose the stomach. A thread was passed at the pyloric end under the pyloric sphincter. Also, an incision on the duodenum was made near the pyloric sphincter, cannulated and firmly tied.

An orogastric infusion tube was carefully passed through the oesophagus to the stomach and ligated just behind the tracheal cannula to prevent reflux. The exposed end of the orogastric tube was passed through a water bath to maintain the perfusate at 37°C and to pre warm the experimental solution. The other end of the orogastric tube was attached to a 50ml syringe mounted on a perfusor pump. The animals' warmth was maintained using a table lamp at body temperature of 37°C and temperature monitored

Measurement of gastric acid output

The modified method of Gosh and Schild [8] by Osim et al., [9] was used. The rats were first perfused with 0.9% normal saline at the rate of 0.1ml/min. The aliquots were collected at 10 minutes interval of infusion. Perfusates were titrated with 0.01N NaOH using phenolphthalein as an indicator. Change in colour from colourless to pink indicated the end point of the titration and the volume of the base used was recorded. The first 10-20 minutes effluent collected was not used because of possible increase in acid secretion due to trauma. When a stable acid secretion was obtained, cimetidine (11.40mg/kg body weight,) was administered, followed by histamine (100mg/kg body weight,) and acid output determined every 10 minutes using the method described above.

Drug Treatment

Drugs used in this study were cimetidine (Sigma, UK), and histamine (Sigma, UK),

Statistical Analysis

The results were all expressed as mean \pm SEM. The results were compared using the one way analysis of variance, followed by a Post-hoc test (LSD-test). P value less than 0.05 were considered significant.

RESULTS

Effects of extract on pepsin activity and mucous secretion

Dalium guineense fruit pulp caused a significant ($p<0.05$) decrease in pepsin activity in the low dose (300mg/kg) and high dose (500mg/kg) groups compared to control (Table 1). There was also a significant ($p<0.05$) increase in gastric mucous secretion in the treatment groups compared to control (Table 1)

Effects of extract on gastric acid secretion

Basal concentration of gastric acid output were significantly lower in the extract treated groups ($p<0.05$). Gastric acid output following Histamine induced stimulation was significantly ($p<0.01$) lower in the low dose and high dose groups respectively. Similarly, cimetidine infusion significantly ($p<0.05$) blocked gastric acid secretion in the treated group when compared to control (Table 2).

Table 1: The effect of *Dalium guineense* on pepsin level and mucous secretion

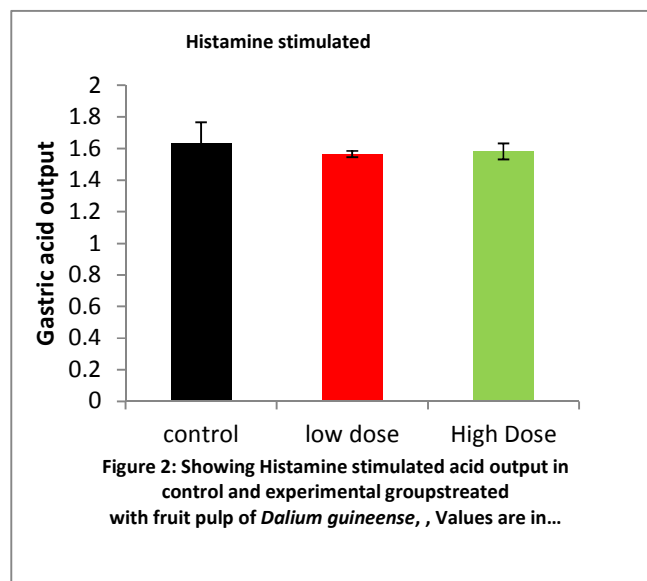
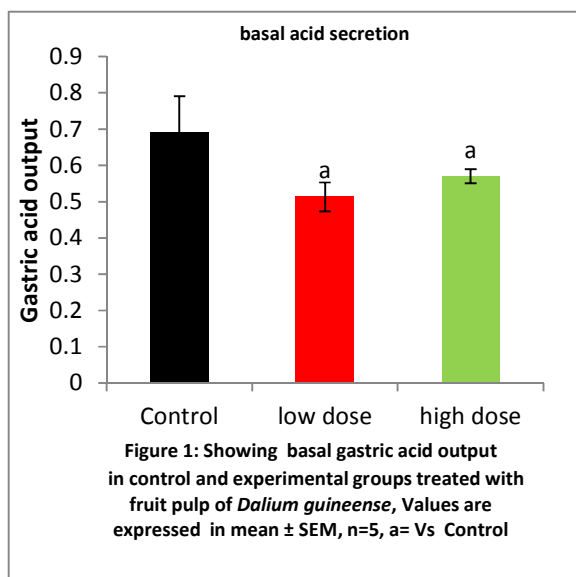
Variable	Control	Low dose	High dose
Pepsin activity	0.4280±0.018	0.3140±0.008	0.3180±0.0106
Mucous secretion	0.42±0.03	0.60±0.03*	0.59±0.32*

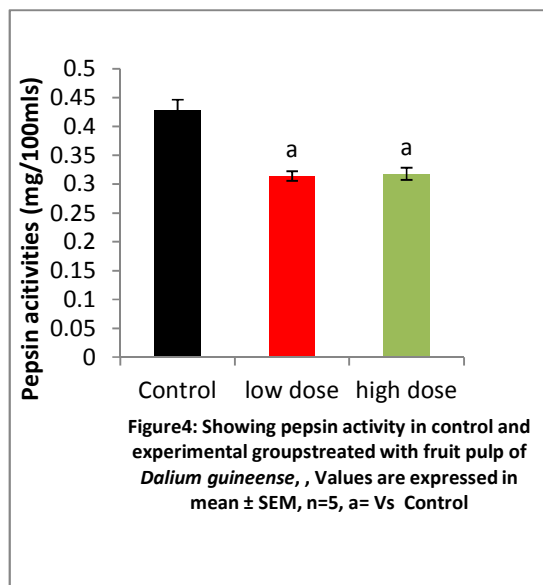
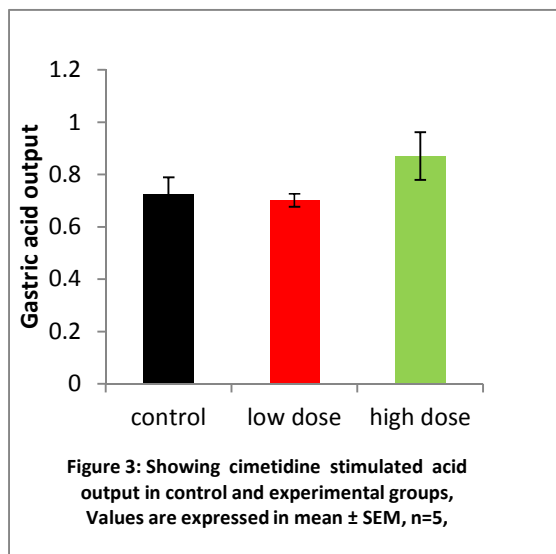
All values are expressed as mean±SEM, n=7 in each group. * $p<0.05$ compared with the control group.

Table 2: The effect of aqueous extract of fruit pulp of *Dalium guineense* gastric acid secretion

Variable	Control	Low dose(300mg/kg)	High dose(500mg/kg)
Basal Secretion(μmol/hr)	0.69±0.101	0.513±0.04*	0.53±0.02*
Histamine stimulated secretion (μmol/hr)	1.637±0.13	1.565±0.02*	1.562±0.05*
Cimetidine (μmol/hr)	0.7225±0.066	0.701±0.025	0.87±0.091

All values are expressed as mean±SEM, n=7 in each group. * $p<0.05$ compared with the control group.





DISCUSSION

In the present study, the effect of aqueous extract of the fruit pulp of *Dialium guineense* on gastric acid secretion, mucus secretion and pepsin activity was studied. The study showed that supplementation of the pulp of the fruit of *Dialium guineense* reduces gastric acid secretion, decreases pepsin activity and promotes mucus secretion in rats. The imbalanced pepsin ratio between the level of acid secretion or production of free radicals within the gastrointestinal tract and the anti-oxidant activity of some available agents have been reported to play a major contributory role in compromising the integrity of the gastric mucosa thereby leading to excoriation of the mucosal lumen [10, 11].

Various reports have identified flavonoids, Saponnins, Tannins, steroids alkaloids, terpenoids and cardiac glycosides as phytochemical agents present in both the leaves, stem and fruits of *Dialium guineense* and their efficacy in cytoprotection [2,4,5,12]. Other contents also available in these parts of the plant include vitamin C, folic acid and minerals. In our study, we noted a significant reduction in gastric acid secretion and pepsin activity following the supplementation of pulp extract of *Dialium guineense* both at low and high dosages. The presence of these phenolic compounds and antioxidants in plant extracts have been strongly associated with blockade of production of pepsinogens as a feature of cytoprotection as well as presenting a strong free radical scavenging capacity, inhibition of influx of calcium ions and reduced gastric acid secretion [13]. Tannins on the other hand are known to be astringent with vasoconstricting effects with a strong tendency to precipitate microproteins on the mucosal lining thus creating a non penetrable surface lining that hinders the absorption of toxic materials and prevent proteolytic enzymes from attacking the mucosal lining [14] as well as exhibiting some anti-inflammatory and anti-oxidant property [15,16].

In this study, histamine induced acid secretion was inhibited while the cimetidine (H_2 -receptor blocker inhibitory actions on gastric acid secretion was significantly augmented. These results indicate that the extract may be acting via inhibiting H_2 - histaminergic receptors leading to the blockade of histamine release [17]. Similarly, pepsin activity was reduced while mucus secretion was significantly increased. Phospholipids of the gastric mucus gel layer act as primary barrier to acid induced corrosion in the stomach, establishes hydrophobicity of the epithelial cellular lining of the stomach thereby providing a much desired protection of the mucosal lining.

CONCLUSION

In conclusion, the present study suggests that the pulp of the fruit of *Dialium guineense* has anti-gastric secretory and anti-pepsin activity property and thus offers cytoprotection.

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