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RESEARCH ARTICLE **OJMR0301004-331**

THE GASTRO-PROTECTIVE EFFECT OF ETHANOLIC ROOT EXTRACT OF UVARIA OVATA VIA ULCER SCORES, EXTRACTIBLE MUCUS, GASTRIC ACID SECRETION AND GASTRIC ACTIVITY USING RAT MODELS

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ABSTRACT

The gastro-protective effect of ethanolic root extract of *Uvaria ovata* through ulcer scores, extractible mucus weight, stomach acid secretion and gastric activity was studied using rat models. A total of 40 Wistar rats were used for this study. The animals were separated into 2 experimental groups, namely: chronic (15 rats) and acute (25 rats), with rats in both groups weighing between 100-140g. For the chronic group, group 1 served as the control and received normal feed and distilled water only, group 2 were given low dose of 500mg/kg of *Uvaria ovata* root extract orally along with food and water, and group 3 were given high dose of 1000mg/kg of *Uvaria ovata* root extract orally along with feed and water for 30 days respectively. In the acute study, group 1 received no administration, group 2 were used as the negative control and were administered 800mg/kg of Aspirin. Group 3, which constituted the positive control, were administered 4mg/kg of Omeprazole, followed by 800mg/kg Aspirin. Group 4 were given low dose (400mg/kg) of Uvaria ovata root extract, followed by 800mg/kg of Aspirin, while group 5 were given high dose (800mg/kg) *Uvaria ovata* root extract followed by 800mg/kg of Aspirin. The findings suggested that *Uvaria ovata* root extract provided gastroprotection against gastric ulceration.

Keywords: *Aspirin, Gastric acid, Gastroprotection, Mucus secretion, Ulcer, Uvaria ovata*

INTRODUCTION

Ulcers, whether peptic, oesophagal or duodenal have become an endemic global problem with developing countries experiencing the scourge in a much greater dimension (Wang *et al*., 2016). It is reported that in America, approximately 1 in every 54 persons (accounting for 1.84% of Americans) has an ulcer (Das *et al.,* 2008). With this report, the incidence rate in the developing can only be imagined. A study showed that peptic ulcers caused 301,000 deaths in 2013, which was comparatively lower than in the preceding years (GBD, 2015). The lifetime risk of a person developing a peptic ulcer is approximately 10% (Lanas and Chan, 2017).

If the normal stomach mucosal protective barrier is damaged, gastric acid and the proteolytic enzyme pepsin, both contained in gastric juice, may cause gastric mucosal erosion, thereby resulting in gastric ulcer disease. Experiments conducted by Reddy *et al*. demonstrated that the stomach and small intestinal mucosal linings are highly permeable to hydrochloric acid when damaged or perforated (Reddy *et al*., 2008). When the gastric barriers are broken, gastric acid can leak through the mucosa to the submucosa, causing direct damage which stimulates inflammatory mediators such as histamine, bradykinin, substance P, etc. These inflammatory mediators stimulate further acid secretion, resulting in more damage to the mucosa. Peptic ulcers are exacerbated by hypersecretion of gastric acids, which could be caused by hyperplasia of the parietal cell mass. This makes the mucosal lining susceptible to the corrosive potentials of gastric juice as it trickles down into the small intestine, resulting in intestinal ulcers (Hagen *et al*., 2009). This perhaps explains why most anti-ulcer medications are geared towards reducing stomach acidity.

NSAIDs such as indomethacin, aspirin and ibuprofen are known to cause peptic ulcers, especially when given at high doses. NSAIDs are very useful in reducing fever, pain and inflammation, as they inhibit the actions of the enzyme's cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX-2) which produce prostaglandins that promote pain, inflammation and fever. However, COX-1 also catalyzes the production of a different prostaglandin that shields the GI lining against stomach hydrochloric acid. By inhibiting COX-1, NSAIDs promote ulcers and GI bleeding by making gastric mucosal cells more vulnerable to gastric acid damage (NDDIC, 2010).

Aspirin (acetylsalicylic acid) induces ulcers by inhibiting prostaglandin synthetase in the cyclooxygenase pathway leading to reduced bicarbonate secretion, mucus secretion and blood flow to the mucosa (Wallace *et al*, 2000), thereby resulting in increased susceptibility to mucosal injury and subsequent ulceration of the walls of the stomach and intestines. Aspirin also increases the production of reactive oxygen species, lipid peroxidation and neutrophil infiltration resulting in oxidative phosphorylation of the cells with charged parts of the drug. Aspirin also decreases the effectiveness of juxtamucosal pH gradient which protects the gastroduodenal epithelium owing to its capacity to decrease mucus and bicarbonate secretion (Whittle *et al.*, 2003). Furthermore, aspirin disrupts mucosal phospholipids, thereby inevitably exposing the mucosa to damage by gastric juice. Aspirin is administered orally at a dose of (125-150) mg/kg body weight to induce ulcers in rats (Williamson *et al.*, 1986).

Mucus plays an essential part in maintaining the integrity of the stomach mucosal barrier which protects the walls of the gastrointestinal tract against gastric acidity (Allen and Flemstrom, 2005). If the normal protective gastric barrier is damaged, HCl and pepsin may injure the mucosa, causing gastric or duodenal ulcers. The composition of mucus secreted is slightly different in different parts of the GI tract. The mucus confers resistance to the mucosa to avoid autodigestion by gastrointestinal enzymes. It contains a moderate amount of bicarbonate ions, which are essential in the neutralization of acids. Also, the glycoproteins contained in the mucus possess amphoteric properties that enable them to have buffering effects against acidic and alkaline compositions of the luminal contents (Laine *et al.*, 2008).

Mucin, the main constituent of mucus, is a thick glycosylated protein. It contains a high proportion of sialic acid, fructose, and galactose. Gastric mucin helps to protect and lubricate the gastric mucosa by forming a viscoelastic gel over the entire mucosa. Mucosal integrity is dependent on the balance between the endogenous humoral aggressive factors and the mucosal defence mechanism. Any imbalance between these factors may lead to gastrointestinal disorders (Niv and Boltin, 2012). Omeprazole is an effective proton-pump inhibitor used in peptic ulcer management (Cheng, 2013). Omeprazole competes favourably with newly formulated proton-pump inhibitors such as esomeprazole, rabeprazole, etc. because it is highly efficacious and well-tolerated, promoting its popular use in adults and children (Welage, 2000). Omeprazole has almost absolute bioavailability, as approximately 95% is bound to human plasma proteins. Owing to its effectiveness, the drug is very common in research facilities as a positive control after a peptic ulcer is induced in laboratory animals (Castell, 2005).

Omeprazole inhibits gastric secretion by selectively inhibiting the H+/K+ ATPase enzyme system (an enzyme on the parietal cell that facilitates hydrogen and potassium exchange through the cell). The drug is transformed into an inhibitor which binds covalently to cysteine residues through disulphide bridges on the alpha subunit of the proton pump, thereby inhibiting the secretion of gastric acid for several hours (Sachs *et al*., 2006; Sachs *et al*., 1989). Today, attempts are made to treat disorders through the utilization of plant products. Plants with acclaimed medicinal properties are researched to aid the discovery and development of pure substances with negligible toxicity and side effects compared to existing modern medicine, to provide a template for the formulation of new synthetic drugs (Oluwole and Peter, 2011). *Uvaria ovata* roots are used locally in Southeast Nigeria in the treatment of peptic ulcer disease. The virtual non-existence of written material on this herbal preparation limited the sources for this section to interviews and personal observations. Very little literature exists about the species *Uvaria ovata*, but it is a shrub that grows about 1-2m tall. The branches are characterized by rusty hairs, ovate-shaped leaves, and yellow-coloured flowers which are borne singly in small clusters. The branches are characterized by rusty hairs, ovate-shaped leaves, short, two-flowered, leaf-opposed peduncles, six oval-oblong unequal petals in many stamens, and yellow-coloured flowers which are borne singly in small clusters (Vahl ex Dunal, 2019). *Uvaria ovata* plants, also called “ire” in the Igbo Language, are predominantly grown in the coastal regions of West Africa. The plants have edible fruit which is sold locally in markets in some West African countries (Burkil, 2004). *Uvaria ovata* is also called *urona ovata, uva globosa, uvaria cordata, uvaria globosa and uva schumacheri* (Burkil, 2004).

Sketchy reports exist on the efficacy of the roots in peptic ulcer management. Some rural dwellers in southeast Nigeria formulate concoctions with *Uvaria ovata* and use it in the treatment program of peptic ulcers and amelioration of the abdominal pains associated with them. This raises the need for scientific work on the subject to investigate these claims. This current work will therefore aim to give a sound scientific basis for the evaluation of the contribution of *Uvaria ovata* in the cure of ulcers and serve as a reference for further research on the plant extract. It is also a deliberate attempt geared towards validating local claims on the usefulness of the plant.

METHODOLOGY

SAMPLE IDENTIFICATION AND COLLECTION

Fresh roots of *Uvaria ovata* were collected from fallow grassland in Umuahia, Umuahia Local Government Area of Abia State, Nigeria, and they were authenticated at the Department of Forestry, College of Natural Resources and Environmental Management, Michael Okpara University of Agriculture, Umudike, Nigeria, where it was assigned the voucher number: MOUAU/ZEB/HERB/2019/021.

PREPARATION OF PLANT EXTRACT

The root extract was prepared according to the method used by Jensen, (2007). The collected fresh roots of *Uvaria ovata* were dried under shade for 14 days, after which they were pulverized to powder using a manual blender. Ethanol was the solvent used to extract 50g of the blended Uvaria ovata roots in the Soxhlet extractor for 48 hours at a temperature of 60^0C. After extraction, the sample was dried to obtain an extract of 9.4g, which was preserved in a freezer at a very low temperature until needed, after ascertaining its percentage yield.

$$\text{Percentage Yield} = \frac{X}{Y} \times 100\%$$

Where X = weight of prepared and dried extract

Y = weight of powdered plant material before extraction

$$\text{Therefore, the percentage yield} = \frac{9.4g}{50g} \times 100\%$$

= 18.8%

1g of dried extract was dissolved in 10ml of water to give a stock solution of 0.1g/ml (100mg/ml).

ACUTE TOXICITY TEST LD_{50}

18 Wistar rats of both sexes weighing 100-140g were separated into 6 groups of 3 rats each. The groups were assigned graded oral doses of *Uvaria ovata* root extract accordingly: 10, 100, 1000, 1600, 2900 and 5000mg/kg respectively. The rats, after the administration, were provided feed and water in their various cages and observed for toxicity signs and deaths within 24 hours. The LD_{50} value for the extract was measured using the Lorke method expressed as:

$LD_{50} = \sqrt{A \times B}$

Where;

A = Maximum dose that did not produce mortality

B = Minimum dose that produced mortality

The result (LD_{50}) result was applied in determining the safe dose of *Uvaria ovata* root extract for the experiments.

EXPERIMENTAL DESIGN I (CHRONIC/ONE-MONTH STUDY)

The rats were randomized and grouped for one month and placed in wooden netted cages and maintained in the environmentally controlled room provided with 12:12 hours a day to night ratios approximately at 25C. Fifteen (15) adult albino Wistar rats (100-140g) assigned into 3 groups of 5 (n=5) rats each were used. Group 1 served as control and was administered only food and water throughout the experiment. Group 2 was administered 500mg/kg of *Uvaria ovata* root extract along with food and water. Group 3 was administered 1000mg/kg of *Uvaria ovata* in addition to food and water. The animals were housed and fed for 30 days, and assayed for gastric acid secretion and extractible mucus weight as illustrated in table 1 below:

Table 1: Experimental design I

S.No	Grouping		Treatment	Duration	No. of rats
1	Group 1	Control	Feed and water	30 days	5 rats
2	Group 2	Low dose	500mg/kg *Uvaria ovata* + feed and water	30 days	5 rats
3	Group 3	High dose	1000mg/kg *Uvaria ovata* + feed and water	30 days	5 rats

DETERMINATION OF THE EFFECT OF *UVARIA OVATA* ROOT EXTRACT ON GASTRIC ACID SECRETION

Each animal was laid on a dissecting board and an incision was made on the neck to expose the trachea for tracheal cannulation. This was to allow for clear airways. Another incision was made on the abdomen about an inch along the linea alba. The stomach was exposed, and a thread was passed at the pyloric end under the pyloric sphincter exposing the small intestine and part of the liver. A transaction was done close to the pylorus. A pyloric cannula was inserted and kept in place by a thread. Exposed organs of the abdomen were concealed with a normal saline cover. A cannula was carefully inserted from the mouth to the stomach. The temperature was maintained through the procedure by a heating lamp to prevent hypothermia. The orogastric infusion of saline was done slowly at 1ml per minute. The stomach perfusate was collected from the duodenal end and was in each case titrated against 0.01N NaOH using methyl orange as an indicator. The calculation of acid secreted in milliEquivalent or millimole per unit time follows the principle that states that a gram equivalent of acid balances a gram equivalent of the base at the neutralization point. Hence Normality (N) of acid x volume of Acid (V) = Normality (N) of base x volume of base i.e, $N_AV_A = N_B$

x V_B. The Normality of the base is 0.01. The volume, which is derived from the titrate, yields NxVi.e gram equivalent of acid.

DETERMINATION OF THE EFFECT OF UVARIA OVATA ROOT EXTRACT ON THE EXTRACTIBLE WEIGHT OF MUCUS

Extractible gastric mucus was assayed by the method described by Ettar and Okwari, (1999). The stomach of each sacrificed rat was extracted. An incision was made along the greater curvature, after which it was washed and rinsed in normal saline. Dissecting pins were used to pin each stomach to a corkboard. Mucus was extracted using a spatula from the spread stomach into a known weight beaker containing 4ml of water. The weight of mucus was the difference between the weight of the beaker plus 4ml of water and the final weight in grams.

EXPERIMENTAL DESIGN II (ACUTE/24-HOUR STUDY)

Twenty-five (25) rats were assigned into 5 groups of 5 rats each. They were starved for 24 hours before the experiment. Group 1 was controlled and was not administered anything throughout the experiment. Group 2 was the negative control (no treatment before ulcer induction). Group 3 was a positive control, and the rats were administered 4mg/kg of Omeprazole (before the ulcer was induced). Groups 4 and 5 received oral doses of 400 and 800 mg/kg respectively of *Uvaria ovata* root extract before ulcer induction. 30 minutes later, the rats in groups 2, 3, 4 and 5 were administered aspirin (800mg/kg) to induce ulcers. For a further two hours, the animals were sacrificed and tested for ulcer scores and general gastric activity (gastric pH, total acidity and pepsin activity). This is illustrated in Table 2 below:

Table 2: Experimental design II

S.No	Grouping		Treatment	Duration	No. of rats
1	Group 1	Control	No administration	1 day	5
2	Group 2	Negative control	800mg/kg Aspirin	1 day	5
3	Group 3	Positive control	4mg/kg Omeprazole, followed by 800mg/kg Aspirin	1 day	5
4	Group 4	Low dose	400mg/kg *Uvaria ovata*, followed by 800mg/kg Aspirin	1 day	5
5	Group 5	High dose	800mg/kg *Uvaria ovata*, followed by 800mg/kg Aspirin	1 day	5

EVALUATION OF THE EFFECT OF *UVARIA OVATA* ROOT EXTRACT ON ULCER SCORES

Each rat's stomach was carefully removed, washed, and opened along the greater curvature. The isolated stomachs were rinsed with normal saline before being fastened with pins to a board for proper visualization. A magnifying lens and ruler were used to measure the extent of ulcerations. Scoring of ulcer spots was done according to the method used by Hemamalini *et al.,* (2012) as shown in the grading system below:

Grading of ulcerated spots

Normal Stomach	=	0
Red Colouration	=	0.5
Spot ulcers	=	1
Haemorrhagic streaks	=	1.5
Ulcers > 3mm < 5mm	=	2
Ulcers > 5mm	=	3

The procedures involving the animal models conformed to the guiding principles in the care and the use of animals by the American Physiological Society, (2002).

Statistical analysis. Data were expressed as mean±SEM and their group will be evaluated by ANOVA.

RESULTS

ACUTE TOXICITY STUDY

There was no recorded death following the 24-hour duration of the acute toxicity study, including the highest dose of 5000 mg/kg body weight. The mice instead had normal disposition both physically and mechanically and were emotionally stable and all survived the 24 hours of acute toxicity study and beyond.

EFFECT OF *UVARIA OVATA* ON GASTRIC ACID SECRETION

As represented in table 3 below, the mean gastric acid secretion in the control, group 2 and group 3 was 9.67±0.23, 6.94±0.48 and 5.50±0.51 mmol/L respectively. The result showed that gastric acid secretion in groups 2 and 3 were significantly lower than in the control ($P<0.05$). The result also revealed that gastric acid secretion in group 3 (high dose) was significantly lower than in group 2 (low dose).

Table 3: Effect of *Uvaria ovata* on gastric acid secretion

Treatment groups	Gastric acid secretion (mmol/L)
Control	9.67 ± 0.23^{c}
U.O root extract 500 mg/kg	6.94 ± 0.48^{b}
U.O root extract 1000 mg/kg	5.50 ± 0.51^{a}

Values are presented as mean ± standard deviation (n = 5) and values with different superscripts are significantly ($P<0.05$) different from any paired mean.

EFFECT OF *UVARIA OVATA* ON EXTRACTIBLE MUCUS WEIGHT

Table 4 below shows that the average values of extractible mucus weight of control, group 2 and group 3 were 0.038±0.003, 0.048±0.003 and 0.065±0.004 g respectively. The values of the test groups (groups 2 and 3) were significantly higher ($P<0.05$) than the control. The value for group 3 was also significantly higher than group 2.

Table 4: Effect of *Uvaria ovata* on extractible mucus weight

Treatment groups	Mucus weight (g)	Relative mucus weight
Control	0.038±0.003[a]	0.021±0.003[a]
U. O root extract 500 mg/kg	0.048±0.003[b]	0.028±0.002[b]
U. O root extract 1000 mg/kg	0.065±0.004[c]	0.039±0.004[c]

Values are presented as mean ± standard deviation (n = 5) and values with different superscripts are significantly ($P<0.05$) different from any paired mean

EFFECT OF *UVARIA OVATA* ON GENERAL GASTRIC ACTIVITY

Table 5 below shows the mean values of the gastric pH in group 1 (normal control), group 2 (negative control left untreated after aspirin ulcer-induction), group 3 (omeprazole 4mg/kg after aspirin ulcer-induction), group 4 (U.o 400mg/kg after aspirin ulcer-induction) and group 5 (U.o 800mg/kg after aspirin ulcer-induction) as 2.52±0.05, 2.15±0.05, 2.86±0.03, 2.95±0.02 and 3.05±0.07 respectively. Group 2 mean pH value was significantly lower than the values for each of the groups 1 (control), 3, 4 and 5. Group 3 (omeprazole) mean pH value was significantly higher than each of the group 1 and group 2, but significantly lower than each of groups 4 and 5. Group 4 mean pH value was significantly higher than the values for each of the control, groups 2, and 3, but significantly lower than the values for group 5. Group 5 mean gastric pH value was significantly higher than the values for each of the control, groups 2, 3 and 4 ($P<0.05$).

Table 5 below shows the mean values of total acidity in group 1 (normal control), group 2 (negative control left untreated after aspirin ulcer-induction), group 3 (omeprazole 4mg/kg after aspirin ulcer-induction), group 4 (U.o 400mg/kg after aspirin ulcer-induction) and group 5 (U.o 800mg/kg after aspirin ulcer-induction) as 9.89±0.05, 16.27±0.40, 13.83±0.15, 13.63±0.25 and 12.17±0.31 respectively. Group 2 mean total acidity value was significantly higher than the values for each of the groups 1 (control), 3, 4 and 5. Group 3 (omeprazole) and group 4 (low dose) mean total acidity values were significantly higher than each group 1 and group 5, but significantly lower than group 2, with no significant difference in total acidity between each other. Group 5 mean total acidity value was significantly lower than the values for each of groups 2, 3 and 4, but significantly higher than the total acidity in group 1($P<0.05$).
Table 5 below shows the mean values of pepsin activity in group 1 (normal control), group 2 (negative control left untreated after aspirin ulcer-induction), group 3 (omeprazole 4mg/kg after aspirin ulcer-induction), group 4 (U.o 400mg/kg after aspirin ulcer-induction) and group 5 (U.o 800mg/kg after aspirin ulcer-induction) as 82.37±1.15, 116.67±0.38, 102.63±0.81, 103.40±1.30 and 99.70±1.41 respectively. Group 2 mean pepsin activity value was

significantly higher than the values for each of the groups 1 (control), 3, 4 and 5. Group 3 (omeprazole) and group 4 (low dose) mean pepsin activity values were significantly higher than each of group 1 and group 5, but significantly lower than group 2, with no significant difference in pepsin activity between each other. Group 5 mean pepsin activity value was significantly lower than the values for each of groups 2, 3 and 4, but significantly higher than the total acidity in group 1($P<0.05$).

Table 5: Effect of *Uvaria ovata* on general gastric activity

Treatment groups	Gastric pH	Total acidity	Pepsin activity
Normal control	2.52 ± 0.05^{b}	9.89 ± 0.05^{a}	82.37 ± 1.15^{a}
Negative control	2.15 ± 0.05^{a}	16.27 ± 0.40^{d}	116.67 ± 0.38^{d}
Omeprazole 4 mg/kg	2.86 ± 0.03^{c}	13.83 ± 0.15^{c}	102.63 ± 0.81^{c}
U. O root extract 400 mg/kg	2.95 ± 0.02^{d}	13.63 ± 0.25^{c}	103.40 ± 1.30^{c}
U. O root extract 800 mg/kg	3.05 ± 0.07^{e}	12.17 ± 0.31^{b}	99.70 ± 1.41^{b}

GASTROPROTECTIVE EFFECT OF *UVARIA OVATA* ON THE ULCER

As represented in table 6, the mean ulcer score values of group 1 (normal control), group 2, group 3, group 4 and group 5 were 0.00±0.00, 21.33±2.08, 6.67±1.16, 5.00±1.73 and 5.00±1.00 respectively. The ulcer score values in groups 3, 4 and 5 were significantly lower ($P<0.05$) when compared with the untreated negative control (group 2). The percentage inhibition of ulcer in groups 1, 2, 3, 4 and 5 were 100.00±0.00, 0.00±0.00, 46.53±4.93, 51.83±6.60 and 55.07±0.57 % respectively. The percentage ulcer inhibition in groups 3, 4 and 5 was significantly higher than the negative control in group 2 ($P<0.05$).

Table 6: ffect of *Uvaria ovata* on ulcer scores

Treatment groups	Ulcer score	Average ulcer score	% of animals with ulcer	Ulcer index	% inhibition of ulcer
Normal control	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	100.00 ± 0.00^{d}
Negative control	21.33 ± 2.08^{c}	9.00 ± 1.00^{c}	94.33 ± 4.04^{c}	12.47 ± 0.46^{d}	0.00 ± 0.00^{a}
Omeprazole 4 mg/kg	6.67 ± 1.16^{b}	4.33 ± 0.58^{b}	56.00 ± 6.25^{b}	6.67 ± 0.67^{c}	46.53 ± 4.93^{b}
U. O root extract 400 mg/kg	5.00 ± 1.73^{b}	3.67 ± 0.51^{b}	51.33 ± 7.77^{b}	$6.00\pm0.78^{b,c}$	$51.83\pm6.60^{b,c}$
U. O root extract 800 mg/kg	5.00 ± 1.00^{b}	3.33 ± 0.25^{b}	47.67 ± 1.53^{b}	5.60 ± 0.26^{b}	55.07 ± 0.57^{c}

Values are presented as mean ± standard deviation (n = 5) and values with different superscripts are significantly ($P<0.05$) different from any paired mean

DISCUSSION

The result of gastric acid secretion after the long-term study of 30 days showed a highly significant lowering of the volume and concentration of gastric juice in the test groups when compared with the control. Extractible mucus weight was significantly increased in the test groups when compared with the control. Mucus serves a major function in the maintenance of the mucosal barrier and subsequent gastroprotection against pepsin and hydrochloric acid which initiate ulcerations (Nurhidiya *et al*., 2014). The synthesis and secretion of this mucus are facilitated by prostaglandins. There is a growing body of evidence that the stress mounted by ulcer induction increases the formation of reactive oxygen species which decreases cell proliferation rate and prostaglandin synthesis while increasing gastric juice secretion to cause alterations in the circulating nitric oxide which erodes the gastric mucosa (Brzozowski *et al*., 2001).

Aspirin induces ulcer because it lowers the hydrophobic potential of the mucus gel layer, minimizing the activity of surface-active phospholipids and suppressing prostaglandin synthesis (Saeed, 2006). Administration of *Uvaria ovata* root extract to the test groups exhibited significant gastroprotection when compared with control, as ulcer scores were significantly lowered in all treated rats when compared with control rats that received no treatment. The result at the end of the experiment showed a significant increase in pH and a significant decrease in total acidity and pepsin activity in the *Uvaria ovata* treated groups, and as expected, the omeprazole group, when compared with the negative control. The *Uvaria ovata* groups even performed better than the standard drug, omeprazole, in acid reduction.

By its effect on significantly reducing ulcer score and significantly increasing gastric pH and extractible mucus weight, it may be safe to infer that *Uvaria ovata* possesses a tremendous gastroprotective effect against peptic ulcer disease. It may be possible that these ulcer-inducing mechanisms of aspirin were significantly inhibited in the *Uvaria ovata* treated rats and may be responsible for the observed gastroprotection and low ulcer score values observed in the stomachs of these rats when compared with the negative control rats which received no *Uvaria ovata* treatment.

CONCLUSION

The result of the study indicated that *Uvaria ovata* exhibited significant gastroprotective activity against aspirin-induced ulceration, lowering ulcer scores and gastric activity, and significantly increasing extractible mucus secretion in all treated groups compared with control.

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