Gastric Cytoprotective Effects of Olive Oil on Acid-alcohol Induced Gastric Ulceration in Albino Rats

Adeleye, G. S.
***Nwozor, C. M.**
Adoro, O. M.
Department of Physiology
Anambra State University, Uli, Nigeria
**E-mail: corneliusnwozor@gmail.com, corneliusnwozor@yahoo.com*

ABSTRACT

Olive oil is a fat from the olive (the fruit of Oleaeuropaea). Gastric cytoprotection is protection of gastric mucosa against injury by mechanism other than inhibition and neutralization of gastric acid. This study is undertaken to investigate the cytroprotective effects of olive oil on acid-alcohol induced gastric lesions in albino rats. Fifteen healthy male albino rats of Wistar strain weighing between 180-220g were used for the study. The animals were randomly assigned into three groups of five rats each. Group 1 served as control and was fed with normal rat chow and water. Group 2 received 10ml of olive oil mixed with feed. Group 3 received 20ml of olive oil mixed with feed daily for forty-five days. At the end of the experiment, the animals were weighed after an overnight fast, anaesthetized with chloroform (0.6ml/100mg body weight). Gastric ulceration was induced using 1.5ml acid-alcohol prepared from equivolume of 0.1NHCL and 70% methanol introduced into the stomach via a portex cannula tied and left in place following an incision made on the antral-pyloric junction of the stomach. After 1 hour, laparatomy was performed. The stomach was cut open along the greater curvature, rinsed with normal saline and pinned on a dissecting board for ulcer examination and scores. The results obtained showed mean ulcer scores of 16 ± 0.71 for the control group and 9.2 ± 0.73 for group 3. The result showed that olive oil significantly reduced ulcer scores as well as caused scanty haemorrhage in the control group. It is concluded that olive oil intake offered cytoprotection on the gastric mucosa in albino rats.

Keywords: *Olive oil, cytoprotection, gastric ulceration, rats.*

INTRODUCTION

Olive oil is a fat from the olive (the fruit of *Oleaeuropaea;* family *Oleaceae*). The oil is produced by grinding whole olives and extracting the oil by mechanical or chemical means. It has been shown that consumption of olive oil can provide heart health benefits such as favourable effects on cholesterol regulation and that it exerts antinflammatory, antithrombotic, antihypertensive as well as vasodilatory effects both in animals and in humans (Covas, 2007). Gastric ulcer is an excoriated area in the lining of the stomach. It is more common in elderly people of 40 years of age

and above in Nigeria (Agbakwuru *et al*, 2006). Resistance to gastric mucosa is offered by protective factors and ulceration occurs when there is imbalance between aggressive and protective factors (Al-kofahi and Attah, 1999). The gastric mucosa is continuously exposed to potentially injurious agents such as acid, pepsin, bile acids, food ingredients, bacterial products (*Helicobacter Pylori*) and drugs (Pesker and Maricic, 1998). Gastric cytoprotection means protection against gastric mucosal injury by mechanism other than inhibition or neutralization of gastric acid. The mechanism of cytoprotection is not well elucidated but several hypotheses have been proposed by various researchers which include increased mucus and bicarbonate secretions (Garner and Heylings, 1979; Kauffman, Keece and Grossman, 1980), increased mucosal blood flow (Kenturek and Robert, 1982), stimulation of mucosal serosal transport of sodium or chloride, increased phospholipids mucosal coating, decreased gastric motility, increased prostaglandin secretion, scavenging of free radicals, stimulation of cellular growth and repair and decreased release of leukotrienes (D'souza and Dhume, 1991).

Beneficial effects of olive oil on cardiovascular system have been reported (Covas, 2007). Additionally, it protects against heart disease as it controls the levels of low density lipoprotein (LDL) cholesterol and raises levels of the high density lipoprotein (LDL) (Drummond, 2010). Despite the fact that it is widely used in cooking, cosmetics, pharmaceuticals, soaps, and as a fuel for traditional oil lamps, there is paucity of report on its cytoprotective effect on the gastric mucosa. This study is therefore undertaken to investigate the cytoprotective effect of olive oil on acid-alcohol induced gastric ulceration in albino rats.

MATERIALS AND METHOD

This study was carried out between July and August 2012, in the department of Physiology, Anambra State University, Uli, Nigeria. Fifteen healthy adult albino rats of Wistarstiain weighing between 180-220g were used for the study. The animals were housed under standard conditions of temperature (23 ± 2^0C), humidity and 12 hours light (7.00am-7.00pm). They were kept in wire-meshed cages and fed with commercial rat pellets and allowed water *ad libitum*. The animals were randomly assigned into three groups of five rats each. Group 1 (control) received only water and normal rat chow. Group 2 received 10ml of olive oil mixed with feed. Group 3 received 20ml of olive oil mixed with feed daily for forty-five days. The experiment was conducted in accordance with National and Institutional Guidelines for the Protection of Animal Welfare. At the end of the experiment, the animals were weighed after an overnight fast, anaesthetized with chloroform (0.6ml/100mg body weight) and incision was made at the pylorus of the stomach. A portex cannula (0.5mm diameter) was inserted via this incision and kept in place by tying over it with silk suture material. 1.5ml acid-alcohol prepared from equivolume of

ISSN: 2350-2169

0.1NHCL and 70% methanol, was instilled through this cannula to the stomach. The animal was left for 1 hour after which the stomach was fully exposed through a laparatomy. The stomach was cut open along the greater curvature and rinsed with normal saline. It was pinned flat on a dissecting board for ulcer examination and scores. Magnifying hand lens and a Vernier caliper were used to magnify and measure the number of ulcer spots. Scoring of ulcer spots were done by methods of Alpin and Ward (1967) and Adeniyi and Oluwole (1990). The data obtained were expressed as mean ± SEM (Standard Error of Mean). The student's t-test was applied and p-values were determined. Differences were considered significant at $P<0.05$.

RESULTS AND DISCUSSION

The result showed significant reduction in mean ulcer scores (9.2 ± 0.73) with scanty haemorrhage in group 3 compared with increased mean ulcer scores (16 ± 0.71) and profuse haemorrhagic stomach of the control group. A photomicrography of a stomach section showing mild infiltration of lamina propria and submucosal membrane. There is acute ulceration of mucosa layer. The superficial mucosa epithelial is eroded . There is high proliferation of parental cells (Figure 1). A photomicrography of a stomach section showing mild chronic infiltration of submucosa layer by inflammatory. There is gastric metaplasia but the ulcer is not seen (Figure 2). A photomicrography of a stomach section showing normal histology of somach body. There is no inflammatory cells. The muscularis layer is clean (Figure 3). The Histological analysis revealed the following:

Group 1 (control): Mild infiltration of lamina propria and submucosal membrane. The superficial mucosal epithelia appeared eroded. There was acute ulceration of mucosal layer and high proliferation of parental cells.

Group 2: There was significant reduced ulceration of mucosa due to olive oil intake.

Group 3: The mucosal and submucosal layers were without inflammatory cells. Some surface epithelial mucosal cells appeared fairly normal. Ulcer was not seen and gastric cells appeared normal with intracellular mucin production.

H&E.

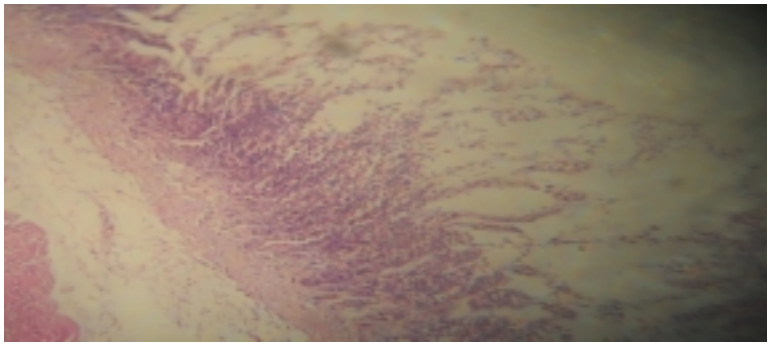

Figure 1: (Control) x 100.

ISSN: 2350-2169

H&E

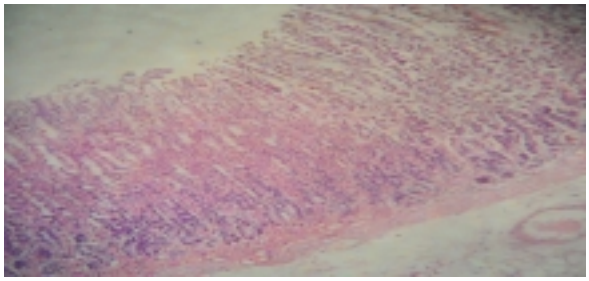

Figure 2: (Group 2) x100.

H&E

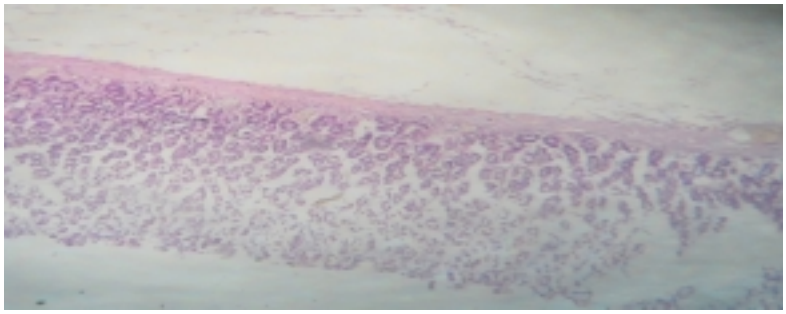

Figure 3: (group3) x100

H&E

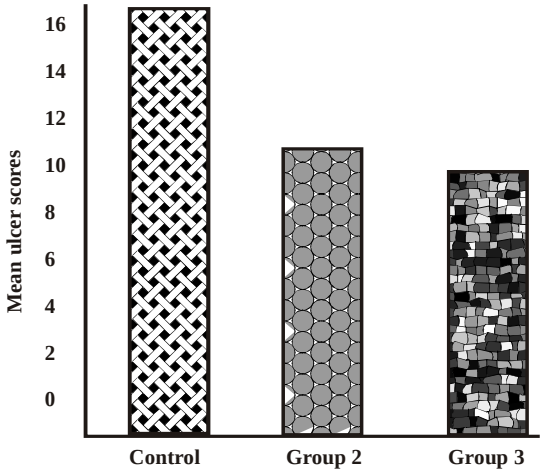

Fig 4: Graphical representation of mean ulcer scores.

The acid-alcohol induced gastric lesion is the most commonly employed test in the evaluation of anti-ulcer and cytoprotective activities (Borreli and Izzo 2000, Konturek *et al*, 1998). Consistent with previous reports in the present study, intragastric administration of acid-alcohol produced acute gastric mucosal injury (Nafeeza *et al*, 1996). The result showed that olive oil significantly reduced mean ulcer scores in group 3 compared with control group. It also showed profuse

haemorrhagic gastric mucosa in the control group compared with scanty haemorrhagic mucosa in the test group. This showed that olive oil offered cytoptrotection on the gastric mucosa in albino rats. It has been proposed that oxygen radical may contribute to the formation of gastric mucosal lesions (Pihan *et al*, 1987) and antioxidants are protective against the damage caused by these oxidants (Toma, Hiruma-Lima, Gverrero and Suoza-Brito, 2005). Olive oil contains a group of related natural products called natural phenols with potent antioxidant properties (Kellie and Peter, 2002). Other phenolic constituents include aldehydicsecoiridoids, flavonoids and lignans (Owen *et al*, 2000).

Earlier studies show that antioxidants play a major role in protection against cellular damage by scavenging free radical formation (Szabo, 1989). Furthermore, several flavonoids prevent gastric mucosal lesions produced by various models of experimental ulcer and protect the gastric mucosa against various necrotic agents. They are the most important plant constituents associated with anti-ulcer activity (Martin, Motilva and Alarcon de la lastra, 1993). Reports of laboratory research have shown that compounds like flavonoids may inhibit growth of *Helicobacter Pylori*, in addition to their direct cytoprotective effects (Beil, Birkholz and Sewing, 1995). Generally, many plants with flavonoidal activities have been shown to be promising in the development of potent anti-ulcer drugs (Olaleye and Farombi, 2006).

CONCLUSION

Nature has provided all that is needed for effective, efficient and productive life. This experiment is conducted to evaluate the gastric cytoprotective effects of Olive oil on acid-alcohol induced gastric ulceration in Albino rats. The overall effect of olive oil intake on the gastric mucosa revealed significant reduction in the risk of ulcer as shown in the test groups. This beneficial effect can be attributed to the biological antioxidants it contains. Further research is highly recommended especially in higher animals including man. Other possible mechanisms of action can be elucidated. It is therefore concluded that olive oil offered cytoprotection on the gastric mucosa in albino rats.

REFERENCES

Adeniyi, K. O.and **Oluwole F. S.** (1990). Influence of thyroid hormones on indomethacin-induced gastric ulceration in rats. *Nigerian Journal of Physiological Sciences,* 6(2), 192-196.

Alpin, R. S. and **Ward, J. W.** (1967). Action of hexapyronium bromide on gastric secretion in dogs and ulceration in rats. *Archieves International and Pharmacodyn Therapeutique.*168 , 82-100.

Agbakwuru E. A.; Fatusi A. O.; Ndububa D. A.; Alatise O. I.; Arigbabu O. A and **Akinola, D. O.** (2006). Pattern and validity of clinical diagnosis of upper gastric intestinal diseases in south- west Nigeria. *Africa Health Science*, 6(2), 98-103.

ISSN: 2350-2169

Al-Kofahi, A. and **Attah A. H.** (1999). Pharmacological screening of the anti-ulcerogenic effect of some Jordanian medicinal plants inrats. *Journal of Ethnopharmacology,* 65, 341-345.

Beil W.; Birkholz W.; and **Sewing K. F.** (1995). Effects of flavonoids on parietal cell acid secretion, gastric mucosal prostaglandin production and *Helicobacyer pylori* growth. *ArzneimittelforSchung,* 45, 697-700.

Borreli, F. and **Izzo, A. A.** (2000). The plant kingdom as a source of anti-ulcer remedies. *Phytother. Research,* 14,581-591

Covas, M. I. (March 2007). Olive oil and the cardiovascular system. *Pharmacol Res.* 55 (3), 175-86.

D'souza, R. S. and **Dhume, V. G.** (1991). Gastric cytoprotection. *London Journal of Physiology and pharmacology,* 35 (2), 88-98

Drummond L. (October 17 2010). Sunday telegraph (Australia). Features P.10

Garner, A. and **Heylings J. R.** (1979). Stimulation of alkaline secretion in amphibians isolated gastric mucosa by 16-16 dimethyl PG E_2 and PG E_2. Proposed explanation for some of the cytoprotective actions of prostaglandins. *Gastroenterology,* 7, 497-503.

Kauffman G. L.; Keece J. J. and **Grossman M. I.** (1980). Gastric bicarbonate secretion.Effect on topical and intravenous 16-16 dimethyl prostaglandin E_2. *American Journal of Physiology,* 239, 44-48.

Kelli, L. Tuck and **Peter J. Hayball** (2002). Major phenolic compounds in olive oil: metabolism and health effects. *The Journal of Nutritional Biochemistry,* 13, (11), 636-644.

Kenturek, S. J. and **Robert, A.** (1982). Cytoprotection of canine gastric mucosa and prostacycline, possible moderation by increased mucosal blood flow. *Digest,* 25,155-63.

Konturek P. C.; Brzowski T, Shwowski Z. Pajido R;, Stachura J., and **Hahn E. G.** (1998). Involvement of nitric oxide and prostaglandins in gastro protection induced by bacterial lipopolysachande. *Scandanavian Journal of Gastroenterology,* 33,691-700.

Martin M. J., Motilva V. and **Alarcon de la lastra C.** (1993). Quercetin and naringenin effects on ulcer formation and gastric secretion in rats. *Phytotherapy research,* 7,150-153.

Nafeeza M. I; Kamsiah J, Aminuddin A.B; Alini M.; Wei K.N.; and **Mohd T. G.** (1996). Effects of dietary palmvitee on alcohol induced ulcer in rats. *Journal of GastroenterolHepatol* 2(suppl): A73.

Olaleye S. B. and **Farombi E. O.** (2006). Attenuation of indomethacin-and HCL/ethanol induced oxidative gastric mucosa damage in rats by kolaviron (Garciniabiflavanones). *Phytother Res.* 20:14-20

Owen R. W;Giacosa A.; Hull W. E; Haubner R; Spiegelhalder B and **Bartsch H.** (2000). *European Journal of Cancer,* 36 (10), 1235-1247.

Pesker B. M. and **Maricic, N.** (1998). Role of prostaglandin in gastroprotection. *Diagnostic Disease Science,* 43,523-529.

Pihan G., Regillo C; and **Szabo, S.** (1987). Free radicals and lipid peroxidation in ethanol or aspinin- induced gastric mucosal injury. *Digestive Dis. Science,* 32:1395-1401.

Szabo, S.C. (1989). Role of radicals in aspinin-induced gastric mucosal lesions. Third International Science Conference on Inflammation. Monte Carlo, Principality of Monaco 15-18 March p 414.

Toma W., Hiruma-Lima C. H., Gverrero R. O. and **Suoza-Brito A. R.** (2005). Preliminary studies of *Mammea Americana* L (GuttiFerae) bark/latex extract point to an effective anti-ulcer effect on gastric ulcer model in mice. *Phytomedicine,* 12, 345-350.

ISSN: 2350-2169