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Gastric Cytoprotection and honey intake in Albino Rats

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Summary: Beneficial effect of honey has been widely reported particularly on wound healings, gastrointestinal disorders and as antibacterial agent. However, there is paucity of report on its cytoprotective effect on the gastric mucosa despite its common usage worldwide including Nigeria. This study was therefore carried out to evaluate the effect of this widely consumed substance on gastric mucosa using animal model and also to explore possible mechanism of its action on the gastric mucosa .Twenty male adult albino rats of Wistar strain, weighing between 210-220g were used in the experiment. They were randomly assigned into two groups, the control group and the honey-fed (test) group, each containing ten rats. The Control group was fed on normal rat feed and water while the test group was fed on normal rat feed with honey added to its drinking water (1ml of honey for every initial 10ml of water for each rat daily) for twenty two weeks. After twenty two weeks the rats were weighed after being starved overnight. They were anaesthetized with urethane (0.6ml/100g 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. The acid-alcohol was allowed to stay for 1hr. After 1hr, laparatomy was performed and the stomach isolated, cut open along the greater curvature, rinsed with normal saline and fastened in place with pins on a dissecting board for ulcer examination and scores. The result obtained showed mean ulcer scores of 14.5$\pm$0.70 for the control group and 1.6$\pm$0.11 for the test group. The result showed that honey significantly reduced ulcer scores as well as caused scanty haemorrhage in the test group compared with increased ulcer scores and multiple haemorrhage in the control group. It is therefore concluded that honey intake offered cytoprotection on the gastric mucosa of albino rats.

Keywords*:* Honey, Gastric mucosa, Cytoprotection.

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INTRODUCTION

A healthy gastrointestinal mucosa possesses a remarkable ability to resist intraluminal gastric acid concentration of pH between 1-1.5. Resistance to gastric mucosa is offered by protective factors and ulceration occurs when there is imbalance between the protective factors and aggressive factors (Davenpot, 1983). Gastric cytoprotection therefore means protection against gastric mucosal injury by mechanism other than inhibition or neutralization of gastric acid. The mechanism of cytoprotection is unknown but several hypotheses have been proposed by various authors which include increase mucus and bicarbonate secretions (Ganong, 2003; Garner and Heylings, 1979; Kauffman et al 1980), increase mucosal blood flow (Dumronglert et al, 1983; Kenturek and Robert, 1982), stimulation of mucosal serosal transport of sodium or chloride (Chouldburry and Jacobson , 1978), increase phospholipids mucosal coating (Litchtenbuger et al 1983), decrease gastric motility, increase prostaglandin secretion, scavenging of free radicals, stimulation of cellular growth and repair and decrease release of leukotrienes (Carbajal et al, 1996; D'souza and Dhume 1991). Beneficial effect of honey has been widely reported particularly on wound healings (Molan, 1998; 1991; Efem, 1988; Bergman et al, 1983), gastrointestinal disorders (Salem, 1981; Haffejea and Moosa, 1985) and as antibacterial agent (Molan, 1993). However, there is paucity of report on its cytoprotective effect on the gastric mucosa despite its common usage worldwide including Nigeria. The study was therefore carried out to determine the effectiveness of honey as an agent for gastric cytoprotection and possible mechanism of its action.

MATERIALS AND METHODS

Twenty adult male albino rats (210-220g) were used. They were housed in the animal house of the Department of Human Physiology, Imo State University, Owerri. The animals were kept in a room temperature of 25^0C in 12-hour light and dark cycles.

They were allowed free access to rat feeds (Pfizer, ltd) and given water freely for the first one month before the experiment commenced.

Experimental design

The animals were divided into two groups, the control group and the honey- fed(test) group, ten rat in each group. The control group was fed with normal rat feeds and water while the test group was fed with normal rat feed with honey added to the drinking water (1ml of honey to every initial 10ml of water for each rat every day) for twenty two weeks. At the end of the experiment, the animals were weighed after an overnight fast, anaesthetized with urethane (0.6ml/100g body weight) and incision was made at the junction between the antrum and the pylorus of the stomach. A portex cannula (0.5 mm 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 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 isolated following laparatomy. The stomach was cut open along the greater curvature and rinsed with normal saline, four pins were used to fasten the tissue in place on a dissecting board for ulcer examination and scores. Magnifying hand lens and a Venier caliper were used to magnify and measure the number of ulcer spots. Scoring of ulcer spots was done by methods of Alpin and Ward (1967) and Adeniyi and Oluwole (1990).

Statistical Analysis

The student's t-test was used for the analysis and comparison of the mean results. P values less than 0.05 were considered significant.

RESULTS

The result showed significant reduction ($p<0.01$) in mean ulcer scores (1.60±.11)

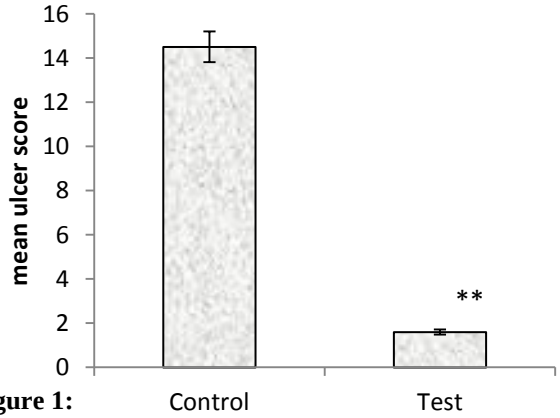

Figure 1: Effect of chronic consumption of honey mean ulcer score, **P<0.01

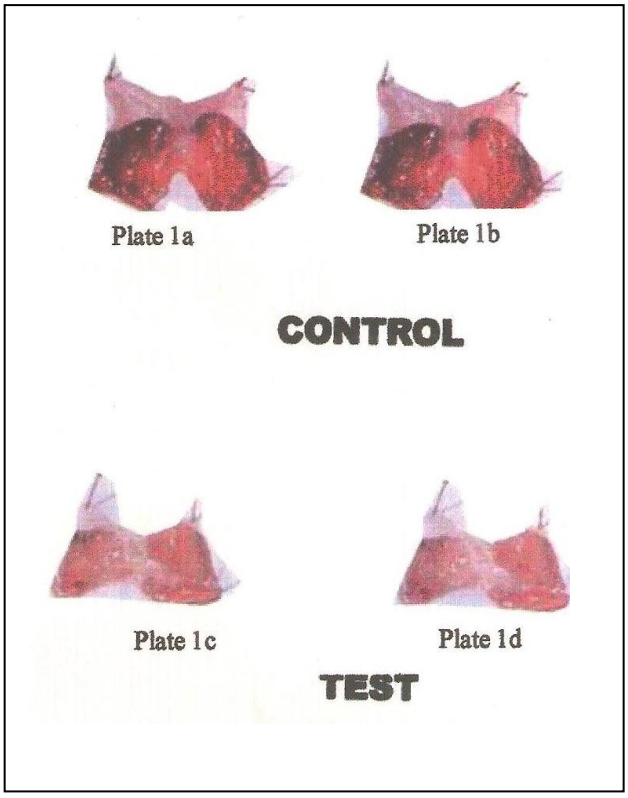

Figure 2. *Photomicrographs showing levels of ulcerated stomach mucosa of Control (plate 1a-b) and test (plates1c-d) animals exposed to chronic honey intake.*

with scanty haemorrhage in the test rats compared with the increased mean ulcer scores (14.5±0.70) and profuse haemorrhagic stomach of the control group as shown in figures 1 and 2.

DISCUSSION

This study was carried out to evaluate the effect of honey intake on the gastric mucosa of albino rats and explore possible mechanism of its action. The result obtained showed that honey significantly reduced mean ulcer scores in the test group when compared with the control ($p<0.01$). It also showed profuse haemorrhagic gastric mucosa in the control group compared with scanty haemorrhagic mucosa in the test group. This showed that honey offered cytoprotection on the gastric mucosa of honey-fed albino rats. The mechanism of this cytoprotection in the test rat was not clear but Alagwu (2008) and Osim et al (2009) observed decrease intestinal motility following honey intake and inhibition of intestinal and biliary smooth muscles with increase mucus and bicarbonate secretions in albino rats. Decrease intestinal motility and inhibition observed in the intestinal smooth muscles and increase in mucus and bicarbonate secretions are methods of cytoprotection (Carbajal et.al, 1996; Ganong, 2008; Dsouza and Dhume, 1991). Arachidonic acid is a constituent of honey (White, 1995; Chatterjea and

Shinde, 2002) and it is a precursor of prostaglandin. Increase prostaglandin has been shown to stimulate mucus and bicarbonate production (Ganong, 2003; Bickel and Kauffman, 1983). This positive relationship enhances cytoprotective effect of honey on gastric mucosa. Apart from this relationship, honey contains antioxidants (White, 1995) which combat free radicals that tend to impede cytoprotection as scavenging of free radicals is a method of cytoprotection (Carbajal et al, 1996; D'souza and Dhume, 1991). Increase mucus production also stimulates bicarbonate concentration (Ganong, 2003) resulting in mucus-bicarbonate trapping that form flexible gel that coats the gastric mucosa. The interrelationship between flexible gel and increase production of prostaglandin further enhances and strengthens cytoprotective effect of honey on the gastric mucosa against damaging effect of induced acid alcohol and acid rich gastric juice. Dumronglert (1983) noted increase blood flow in wound healing with pure national honey. Kenturek and Robert (1982) reported that increase in mucosal blood flow is part of mechanism of cytoprotection.

The overall effect of honey intake on the gastric mucosa generally revealed significant reduction in the risk of ulcer as shown in the honey-fed (test) group. This beneficial effect of honey should however be evaluated further in higher animals including man and its effect is anticipated. It is therefore concluded that honey offered cytoprotection on the gastric mucosa in albino rats.

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