Gastroprotective effect of earthworm paste (*Lampito mauritii*, Kinberg) on experimental gastric ulcer in rats

M. PRAKASH, G. GUNASEKARAN

Department of Zoology, Annamalai University, Annamalainagar, Tamil Nadu (India)

Abstract. – Background: For thousands of years, earthworm and its products have been used for its therapeutic benefits. The traditional medical knowledge of indigenous people throughout the world more particularly in Asia, including India, Myanmar, China, Korea and Vietnam has played vital role in identifying, extracting and using biologically active compounds from earthworms.

Materials and Methods: Effect of various doses (20, 40, 80, 160 and 320 mg/kg, po) of earthworm paste (*Lampito mauritii*, Kinberg) was studied on aspirin-induced gastric ulcer and compared to ranitidine.

Results: The earthworm paste showed significant ulcer protective effects. The cytoprotective effect of the earthworm paste seems to be not only due to the anti-secretory action but also to the effects on mucosal glycoprotein. The decrease in total acidity, pepsin and protein content of the gastric juice proved the antiulcer activity of earthworm paste. Histopathological studies revealed that the earthworm paste was more effective in gastric cytoprotection than ranitidine in preventing lesion formation.

Conclusions: These observations show that the earthworm paste possess antiulcer potential.


Introduction

The organic and functional dyspepsia are common clinical syndromes characterized by pain associated with the stomach. Organic dyspepsia can be caused by peptic ulcer disease, a common gastro-intestinal disorders in clinical practice. The increase in acid-pepsin secretion and decrease in mucosal resistance appears to be the basic causes for peptic ulceration. The aetiology of gastric ulcer is mainly due to defective mucosal resistance. Although the cause of ulceration is not known, gastric acid and pepsin are responsible for maintaining the lesion, once it is produced. The mucosal resistance is lowered by the *Helicobacter pylori*-gram negative bacillus that colonizes the stomach and duodenum. Aspirin a non-steroidal anti-inflammatory drug which induces the peptic ulcer causes increase in gastric secretion, reduces the pH leads to acidity which damages the epithelial cells and sub mucosa layer.

Davenport suggested first that the normal resistance of the gastric mucosa to back diffusion of luminal acid can be disrupted by topical administration of lipid soluble damaging agents such as acetylsalicylic acid or aspirin. Oral administration of aspirin has the ability to transform the gastric mucosa rapidly from a hydrophobic to a more hydrophilic state.

Over the last 25 years, a remarkable revolution in the pathophysiology and treatment of gastric and duodenal ulcers have occurred. Several therapies that have been successful in healing peptic ulcers include neutralizing gastric acid, inhibiting acid secretion and protecting the gastro-duodenal mucosa. Efforts are being made to discover a effective anti-ulcerogenic drug which will not only heal the ulcer but also prevent its recurrence. Search for a suitable drug for the treatment of ulcer from natural products is an ongoing process. Considering the several side effects of modern medicine, indigenous drugs possessing fewer side effects should be looked for as a better alternative for the treatment of ulcer.

Earthworms, a soil macro-invertebrate possess many therapeutic role is recorded in many ancient literature and they are used still in countryside for numerous ailments. For a long period of time, earthworms have been a valuable source of natural products for maintaining human health, especially in India, China and most of the Asian countries. Earthworm derivatives have been used as
drugs against various diseases in China and the Far East for a few thousand years. Earthworms have been used in medicine for various remedies since 1340 A.D. and their medicinal properties have been described by Bristow. According to the description given by Vohora and Khan earthworms have largely been used internally and externally as powerful aphrodisiacs. Mihara et al. and Ismaiel et al. reported that earthworms were capable of digesting intravascular fibrin clots. Bhatnagar and Palta reported that earthworms ingested into our body system increase body heat and are of value in neurologic disorders, bronchitis, tuberculosis and holding a substance effective in curing rheumatism. Recently earthworm protein and its coelomic fluid are known to have cytolytic, agglutination, proteolytic, haemolytic, mitogenic, anti-pyritic, tumorstatic, anti-inflammatory and antibacterial activities. Earthworm tonic is also used for balancing the sympathetic and parasympathetic functions of the central nervous system. In Korea taking “earthworm soup” before going to bed is a traditional habit, which enriches general health and prevents various ailments. Earthworm is formulated as “earth dragon” by allergy research group and used as a suitable drug for the gastro-intestinal disorders caused in gastro-intestinal tract. Hence in the present study efforts have been made to find the antiulceral property of earthworm paste compared with a reference drug ranitidine in rats.

**Materials and Methods**

**Preparation of Earthworm Paste**

Earthworms *Lampito mauritii* (Kinberg) were obtained from the stock culture, Division of Vermi-biotechnology, Department of Zoology, Anna-malai University, Tamil Nadu, India. 500 sexually mature, clitellate worms (900 mg/worm) were washed with running tap water and then fed with wet blotting paper for 18-20 hours for gut clearance. The gut cleared worms were again washed with distilled water. The worms were kept in plastic trough covered tightly with polythene cover and exposed to sunlight for three days to kill the earthworms. Mucus and coelomic fluid that oozed out from the worms digested the dead worms forming a brown coloured paste called “earthworm paste”.

**Animals Used**

Healthy and pure strain male albino rats (Rattus norvegicus), ranging from the body weight of 150-200 gm were procured from the Department of Experimental Medicine, Central Animal House, Rajah Muthiah Medical College, Annamalai University, Annamalainagar and used for the experimental study. The animals were housed in polypropylene cages at 24°C ± 2°C and were fed with proper food and water ad libitum throughout the experiment. The experiment got clearance from the Institutional Animal Ethical Committee (IAEC).

**Drugs**

Aspirin, “earthworm paste” and standard drug ranitidine were suspended in 1% carboxymethyl cellulose before experiment and given orally for 10 days during the experiment.

**Aspirin Plus Pyloric Ligation Induced Ulcer Model**

The methods of Goel et al., Shay et al. and Parmar were followed for the evaluation of anti-ulcerative property. The animals were divided into 8 groups of 6 animals each. Out of 8 groups, group I served as normal control and received water. Group II served as aspirin control receiving aspirin (200 mg/kg). The remaining 6 groups served as treated groups receiving ranitidine (50 mg/kg) – a standard drug and “earthworm paste” administered in different doses (20, 40, 80, 160 and 320 mg/kg). All the doses were administered orally once daily for 10 days. From the 6th day onwards, animals in groups III to VIII received aspirin (200 mg/kg) orally, one hour after the administration of the earthworm paste was done. On the 11th day pylorus ligation was carried out on the 18 hours fasted rats.

**Collection and Analysis of Gastric Juice**

Gastric juice was collected by a 4 h pyloric ligation. Normal rats and those from experimental groups were anaesthetized with ether and cut open through a midline incision in the abdomen. The pylorus was secured and ligated with silk sutures after which the wound was closed and the animals allowed to recover. Drinking water was withheld for 4 h. The rats were then killed by an overdose of chloroform vapours. The stomach was removed after clamping the oesophagus and the gastric contents were collected. The gastric juice was centrifuged at 3500 rpm for 15 min. Aliquots from this was used for the assay of
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Ulcerogens like ACTH, cortisone, ethanol, aspirin and phenylbutazone reduce the rate of secretion of mucus and reduce the concentration of protein bound carbohydrates in the secretion. These agents injure the gastric mucosa by reducing its ability to form a protective layer of mucus. In addition, the ACTH and cortisone decrease the rate of renewal of surface epithelial cells while aspirin and phenylbutazone increases the rate of exfoliation of surface epithelial cells. Aspirin induces gastric lesion (ulcer) by causing back diffusion of H⁺ ions into the mucosal cells. The ethanol or aspirin induced gastric lesions are multifactorial with the depletion of gastric wall mucus content. Mucosal blood flow has also been attributed to be an important factor in the damage caused by non-steroidal anti-inflammatory drugs (NSAIDs) and is modulated by prostaglandin. Submucosal venular constriction by NSAIDs drugs and eventual injury is caused to perturbations of superficial mucosal cells. Aspirin causes leakage of plasma protein into gastric juice. This reflects the increased protein concentration in the gastric juice of aspirin control rats. In the present study pretreatment with earthworm paste decreases the protein concentration in the gastric juice, thereby preventing the plasma membrane from the damage. The administration of 200 mg/kg of aspirin had induced gastric ulcer by producing mucosal damage, gastric lesion, constriction in epithelial cells and decrease in number of cells. Sannugapriya et al. suggested that the presence of polyphenolic compounds prevents damages to the gastric mucosa. Some flavonoids have been shown to increase the mucosal content of prostaglandin and mucus in gastric mucosa, showing their cytoprotective effects. Suggested that pretreatment of ambrex (a herbomineral formulations) on ethanol induced...
damages reduced the gastric lesion and haemorrhage. Falling in line with the above observations in the present study, the pretreatment with earthworm paste had reduced the gastric lesions, increased in number of epithelial cells and reduced the mucosal damage. This may be due to the presence of polyphenolic compounds in earthworm tissue and SH group containing aminoacids, which prevents the gastric damage by increasing the mucin activity. The effect of earthworm paste against gastric ulcer is much better than the ranitidine treatment. Particularly treatment with 160 mg earthworm paste/kg showed better cure than ranitidine. The antiulcer effect of the earthworm paste may be due to the formation of mucin like gel layer on the surface of the mucosa or via the formation of protecting complexes between gel and mucus as a barrier against the agents introduced into the stomach or against endogenously formed acid and pepsin in the stomach. The histopathological observations showed that upon earthworm paste treatment, the mucosal epithelium had retained normal histarchitecture, less haemorrhage and more significant on reduction in ulcer which proves the anti-ulcer activity.

References


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