Research Article

PHARMACOLOGICAL EVALUATION OF *SOLANUM SURATTENSE* LEAVES FOR ANTIULCER ACTIVITY

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ABSTRACT

The extracts of petroleum ether, chloroform, alcohol and aqueous of *Solanum surattense* Burm .f. (Solanaceae) leaves were screened for antiulcer activity by assessing various parameters like pH, free acidity, total acidity and ulcer index. All the extracts were given at dose of 100 mg/kg, b.w. Antiulcer effects were compared with standard drug Omeprazole (20 mg/kg, b.w., p.o.). These observations enable us to conclude that the alcohol extract of *Solanum surattense* leaves showed predominantly significant activity on acid secretory mechanisms in all parameters as compared to other extracts.

Key words: Antiulcer; *Solanum surattense*; Omeprazole.

INTRODUCTION

A peptic ulcer is a hole in the gut lining of the stomach, duodenum, or esophagus. A peptic ulcer of the stomach called a gastric ulcer, of the duodenum, a duodenal ulcer and of the esophagus, an esophageal ulcer. An ulcer occurs when the lining of these organs is corroded by the acidic digestive juices that are secreted by the stomach cells.

For many years, excess acid believed to be the major cause of ulcer disease. Accordingly, treatment emphasis was on neutralizing and inhibiting the secretion of stomach acid. While acid considered significant in ulcer formation, the leading cause of ulcer disease currently believed to be infection of the stomach by bacteria called Helicobacter pyloridus (H. pylori). Another major cause of ulcers is the chronic use of anti-inflammatory medications, commonly referred to as NSAID's (non-steroidal anti-inflammatory drugs), including Aspirin. Cigarette smoking is also an important cause of ulcer formation and ulcer treatment failure[1].

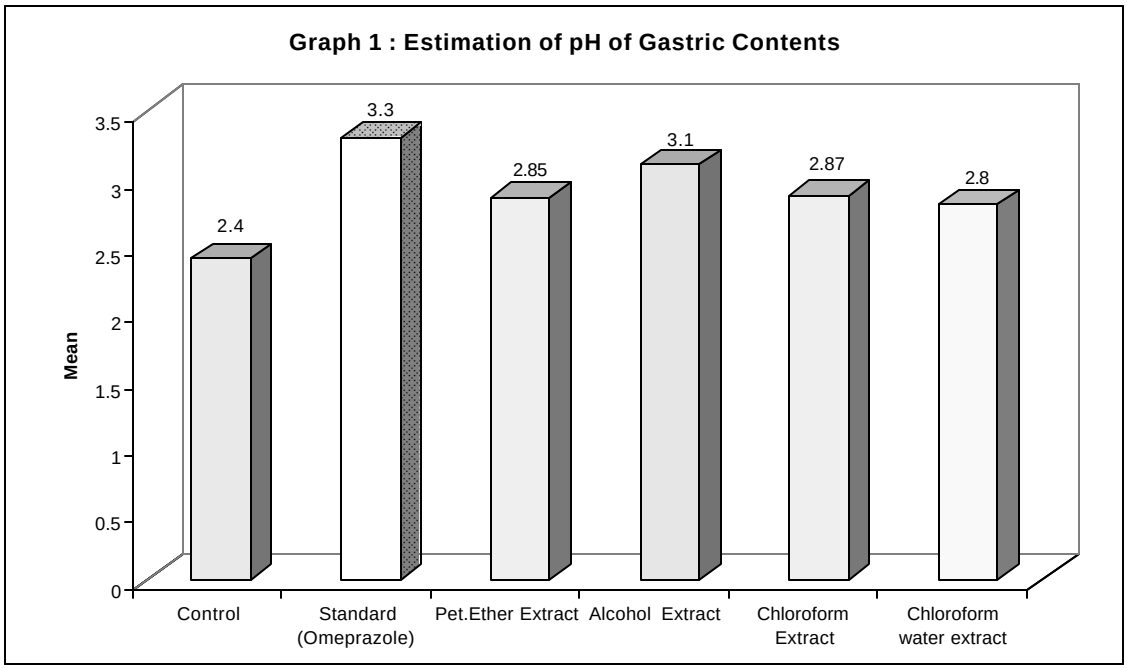
Solanum surattense Burm .f. (Solanaceae) commonly known as Kanteli, Yellow-berried nightshade, Kantakari, Nidigdhika, grows wild almost throughout India, Sri Lanka, south-east Asia, Malaysia and tropical Australia. *Solanum surattense* has been claimed in traditional literature to be valuable against a wide variety of diseases. Indian Materia Medica describes the use of leaves of *Solanum surattense* in the treatment of a number of ailments, including anthelmintic, anti-inflammatory, digestive, carminative, appetizer, stomachic, hypertension, rheumatoid arthritis, fever, cough, asthma, bronchitis, pharyngitis, urolithiasis, amenorrhoea, dysmenorrhoea, lumbago, haemorrhoids, cardiac disorders, rhinopathy, epilepsy and catarrh. The major constituents of roots and fruits of plants contain solanine and solanidine, besides waxy substances, fatty acids and other constituents. Diosgenin is isolated from the fruits[2].

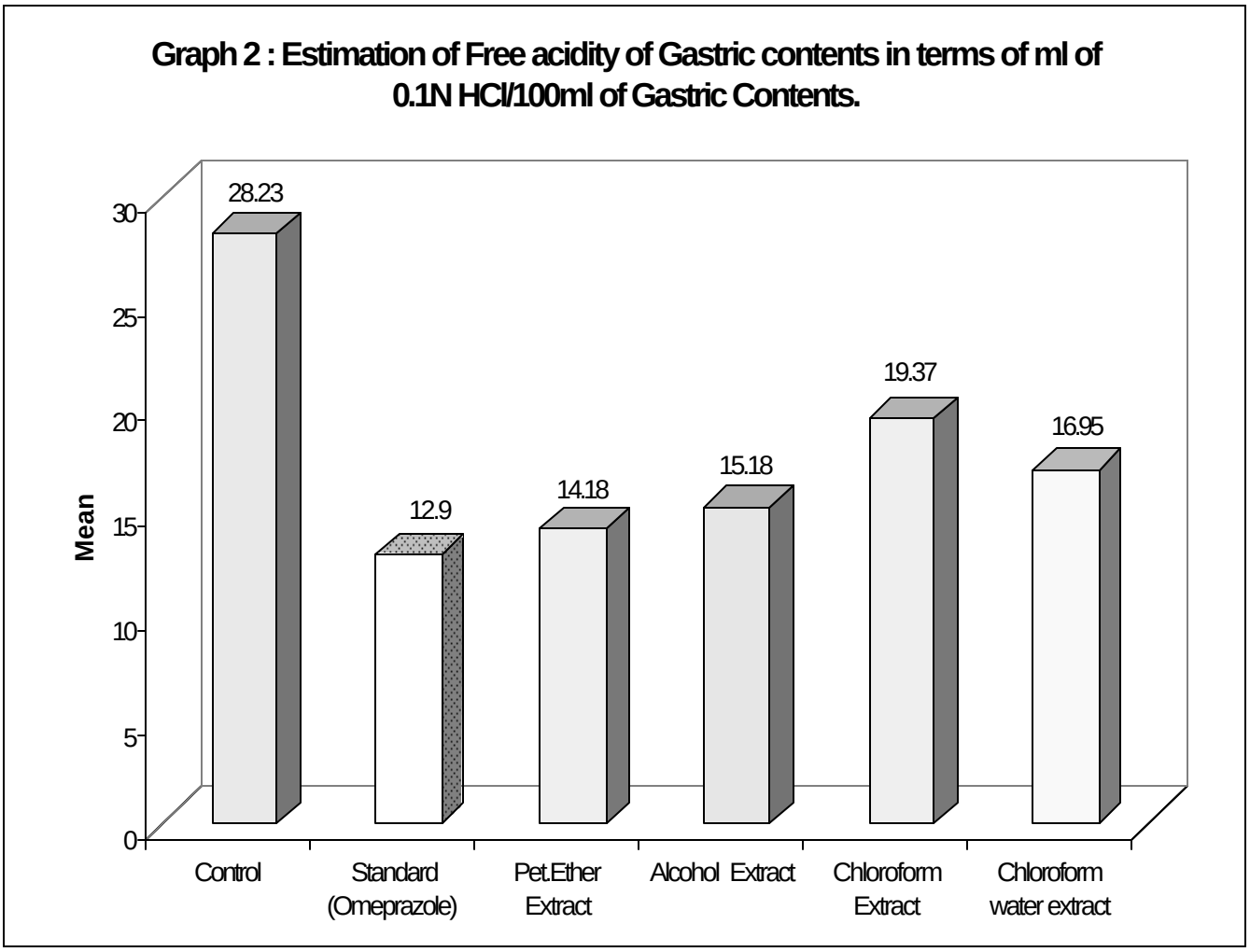
The fruits are known for several medicinal uses such as anthelmintic, antipyretic, laxative, anti-inflammatory, anti-asthmatic, and aphrodisiac activities[3]. The stem, flowers, and fruits are prescribed for relief of burning sensation in the feet

Table No. I. Effect of Different Extracts of *Solanum surattense* Leaves for Antiulcer Activity in Aspirin and Pyloric Ligation Method.

Treatment	Dose mg/kg	pH	Free acidity (mEq/litre)	Total Acidity (mEq/litre)	Ulcer index UI/L
Vehicle	1ml CMC (1%)	2.40±0.05	28.23±0.26	45.67±1.21	4.35±0.30
Petroleum Ether Extract	100	2.85*±0.02	14.18*±0.42	40.47*±0.40	3.13*±0.16
Chloroform Extract	100	2.87*±0.025	19.37*±0.58	40.47*±0.40	2.35*±0.17
Alcohol Extract	100	3.10*±0.18	15.18*±0.42	33.52*±0.37	3.28*±0.15
Aqueous Extract	100	2.80*±0.26	16.95*±0.21	35.22*±0.26	2.48*±0.09
Omeprazole	20	3.30*±0.11	12.9*±0.19	31.23*±0.85	0.008*±0.02

n=6 *p<0.01 vs. control; values are in Mean ± SEM





accompanied by vesicular eruptions[4]. The hot aqueous extract of dried fruits is used for treating cough, fever, and heart diseases[5]. The fruit paste is applied externally to the affected area for treating pimples and swellings[6]. Traditionally, the juice of the leaves is used for treatment of rheumatism, an autoimmune disorder[7].

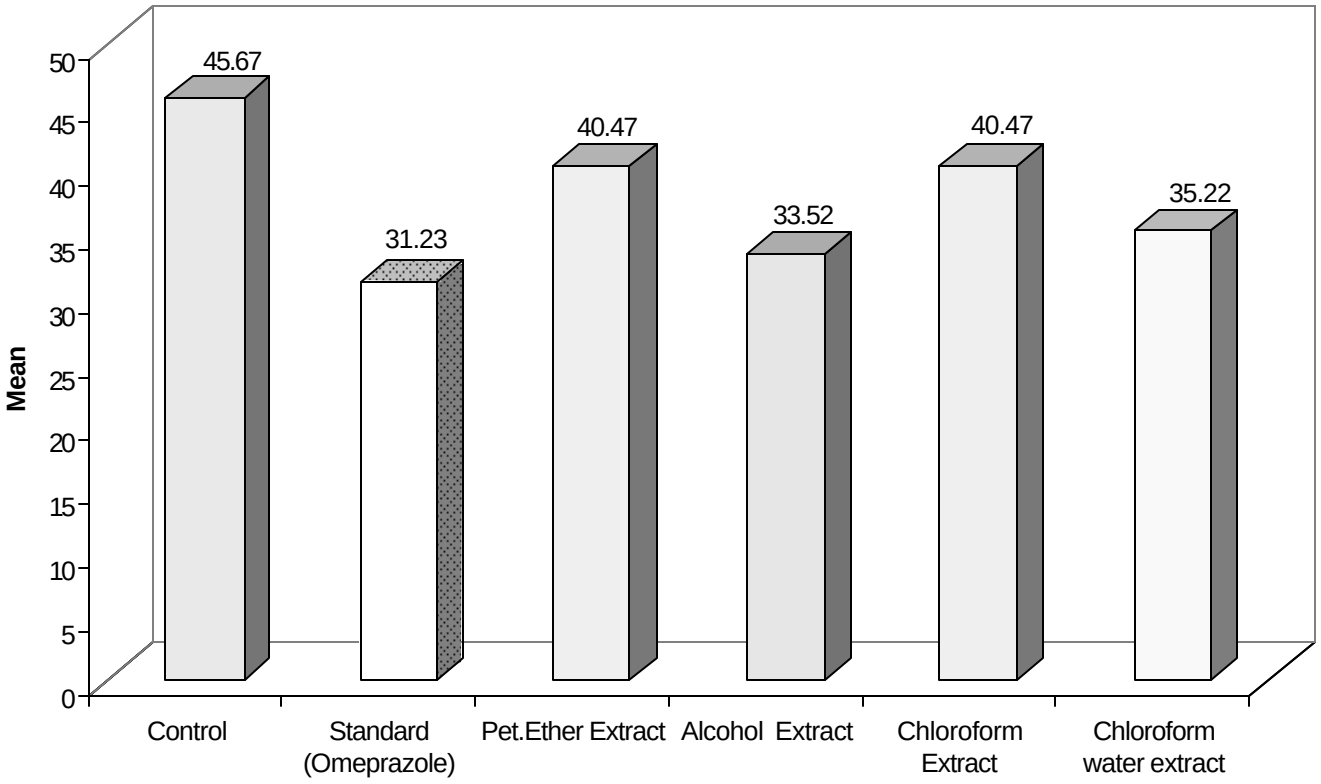
So far no systematic study has been reported for antiulcer properties of *Solanum surattense* leaf extracts. In the present study effort has been made to establish the scientific validity to the antiulcer property of *Solanum surattense* leaves extracts using Aspirin and Pylorus-ligation induced ulceration models in rats.

MATERIALS AND METHODS

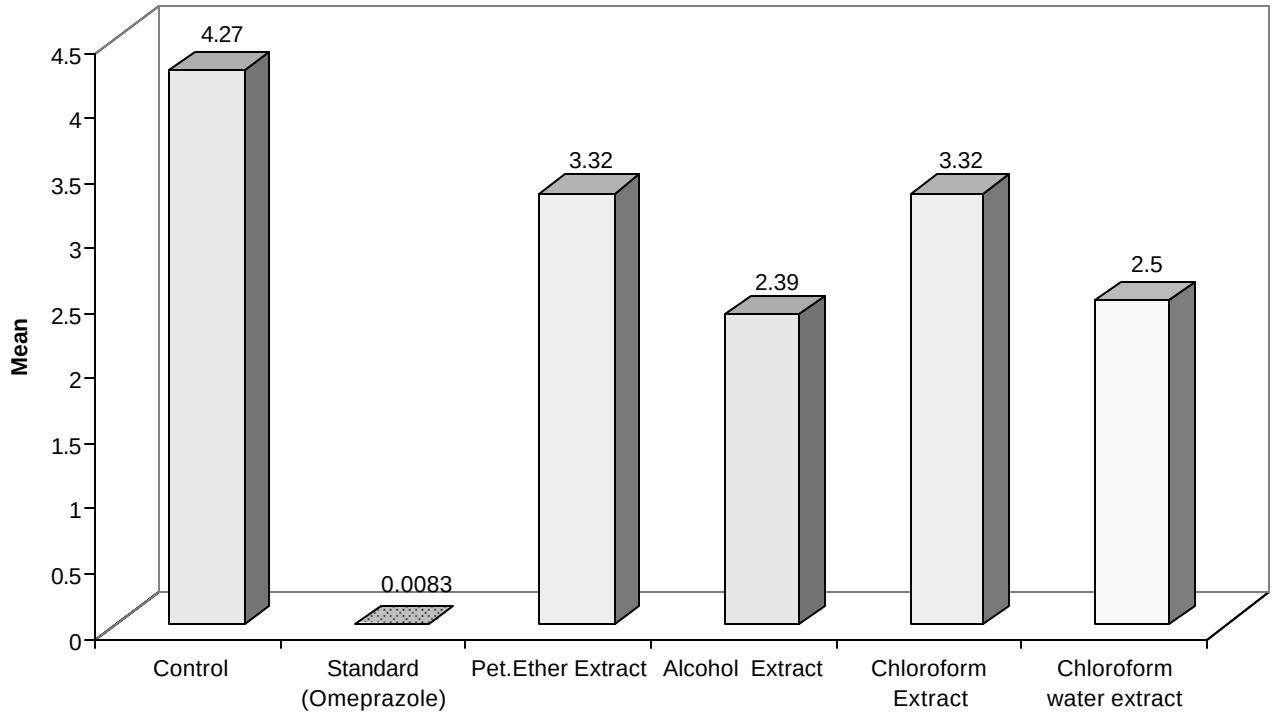
Plant Material and Extraction Procedure: The fresh leaves of *S. surattense* were collected from plants in Belgaum, Karnataka, India and authenticated at Department of Botany, M.M's Science College, Belgaum, India by Smt. Rekha S. Bavadekar. A voucher specimen of the plant was deposited in the Department of Botany herbarium under the number DB/WC/2006/275.

The aqueous extract (AqE, 10%, w/v) of leaves was prepared using distilled water, by maceration method for 7 days at room temperature (yield 8.6%, w/w) and alcoholic extract (AlcE, 10%, w/v) was prepared using 70% (v/v)

Graph 3 : Estimation of Total acidity of Gastric contents in terms of ml of 0.1N HCl/100ml of Gastric Contents.



Graph 4 : Determination of Ulcer index



alcohol by soxhlet method at a temperature of 60-70 ºC (yield 5.4%, w/w). The extracts were concentrated under vacuum and dried over anhydrous sodium sulphate[8]. A suspension of AqE and AlcE in 2% (v/v) Tween 80 was prepared for oral administration by gastric intubation method. Analytical grade reagents were used.

Animals: Albino rats (150–250 g each) of either sex were kept under standard environmental conditions (25 ± 2 °C under 12 h light and 12 h dark cycles). They were housed in cages and fed with regular rat chow (Lipton India Ltd., Mumbai; India) and drinking water *ad libitum*. For experimentation, the animals were fasted overnight and 5 – 10 animals were included in each group. The experimental protocols were approved by standard regulations.

Acute Toxicity Studies: The acute oral toxicity study[9] was carried out as per the guidelines set by Organization for Economic Co-operation and Development (OECD) received from Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA). One-tenth of the median lethal dose (LD_{50}) was taken as an effective dose[10].

Antiulcer Studies:

Aspirin induced ulcers in rats: Six groups of albino rats weighing 150-200 g are used. Each group contains six animals. The test drugs are administered orally in 2% acacia solution 10 min prior to oral Aspirin in a dose of 200 mg/kg (20 mg/ml). Six hours later, the rats are sacrificed in ether anesthesia and their stomachs removed. Formal-Saline (2% v/v) is then injected into the totally legated stomachs for storage overnight. The next day, the stomachs are opened along the greater curvature, then washed in warm water and examined under a 3-fold magnifier. The lengths of the longest diameter of the lesions are measured and summated to give a total lesion score (in mm) for each animal, the mean count for each group being calculated[11, 12].

Pylorus legation induced gastric ulcers: Thirty rats of either sex were randomly divided into five groups and fasted for 48 h with free access to water. Pyloric ligation was performed under light ether anesthesia to each animal. Animals were given 1% Carboxy Methyl Cellulose (CMC) solution or plant extracts 100 mg/ kg or 20 mg/ kg Omeprazole orally immediately after Pylorus-ligation. Animals were sacrificed 4 h later. The stomach was carefully removed and gastric contents were collected. The gastric juice was centrifuged at 3000 rpm for 30 min and the volume of the gastric juice was measured. Free and total acidities in the supernatant were determined by titration with 0.1 N NaOH and expressed as mEq/ L/100 g. The stomach was cut open along the greater curvature and pinned on a soft board for evaluating gastric ulcers and ulcer index was calculated. The percentage inhibition of ulcers was calculated as mean ulcer index of control-mean ulcer index of test / mean ulcer index of control x 100[13, 14].

Evaluation of Antiulcer activity:

Determination of Free Acidity and Total Acidity: The gastric contents were centrifuged at 1000 rpm for 10min. 1ml of supernatant was diluted with 9ml of distilled water. A volume of 2ml diluted gastric juice was titrated with 0.1N Sodium hydroxide run from a micro burette using 3-4 drops of Topfer's reagent as indicator until canary yellow color was observed. Volume of NaOH required was noted. This corresponds to free acidity. Further 2-3 drops of phenolphthalein was added and titrated with NaOH until pink color was restored. This gives total acidity. Free acidity and total acidity is expressed in terms of ml of 0.1N HCl per 100gms of gastric contents. This is the same as mEq/lit. To obtain this figure multiply the burette reading obtained from titration by 10[15, 16].

Ulcer Scoring & Ulcer Index Determination: Each stomach was examined grossly and the ulcers were graded using the following system:

0	-	Normal Mucosa
0.5	-	Red coloration
1.0	-	Spot ulcers
1.5	-	Hemorrhagic streaks
2.0	-	Ulcers >3 but <5
2.5	-	Ulcer >5

Ulcer index was calculated using following formula:

Ulcer Index = 10/x

Where, X = Total mucosal area / Total ulcerated area[17, 18].

Statistical Analysis: The data obtained by the various parameters was statistically evaluated by one way analysis of variance (ANOVA) followed by Dunnett test for individual comparison using Graph Pad Prism software (Graph Pad **software Inc., Version 4.0.0.255). The mean values** SEM were calculated for each parameter. The differences in biochemical parameters between the ulcer induced group and standard drug treated group were considered as 100% and the changes in biochemical parameters by the plant extracts treated groups against the ulcer-induced group were analyzed accordingly. Level of significance was kept at $P<0.01$[16].

RESULTS:

Pharmacological activity led to the conclusion that the alcohol extract exhibited more significant activity than the petroleum-ether, chloroform and aqueous extracts. The results of pharmacological activity also concluded that the alcohol extract significantly raised the pH of gastric contents; it lowered the free and total acidity and ulcer index as compared to stan-

dard drug Omeprazole. The ulcer index in control animals was (4.35). Alcohol extract (3.288) significantly reduced the ulcer index ($p<0.01$). The reduction in ulcer index by petroleum-ether, chloroform and aqueous extracts are 3.13, 2.353 and 2.480 respectively. Omeprazole, a standard antiulcer drug showed no ulcer production.

In control animals, without any drug the mean pH is 2.4. All the four extracts showed rise in pH of gastric contents. Alcohol extract showed rise in pH (3.10) as compared to control. The rises in pH shown by petroleum-ether, chloroform and aqueous extracts are 2.85, 2.87 and 2.80 respectively. Omeprazole, a standard drug raised the pH to (3.30) which is statistically significant ($p<0.01$).

Gastric free acidity is increased to (28.23 mEq/litre) in control animals due to Pylorus-ligation. Alcohol extract (15.18 mEq/litre) showed significant decrease in free acidity ($p<0.001$) as compared to control. The decrease in free acidity by petroleum-ether, chloroform and aqueous extracts was 14.18, 19.37 and 16.95 mEq/litre respectively. When compared with Omeprazole, a known antiulcer drug, alcohol extract is equipotent (12.90 mEq / litre), whereas other extracts are less potent in decreasing gastric acidity.

Gastric total acidity is increased to (45.67 mEq/litre) in control animals. Alcohol extract (33.52 mEq/litre) showed highly significant decrease in total acidity ($p<0.01$) as compared to control. The decrease in total acidity by petroleum-ether, chloroform and aqueous extracts are 40.47, 40.47 and 35.22 mEq/litre respectively. Where as 31.23 mEq/litre decrease in total acidity is by Omeprazole. Result is shown in table no. 1. The results represented as pH, free acidity, total acidity of gastric contents and ulcer index are presented in fig.1, 2, 3 and 4 respectively.

CONCLUSIONS:

It is concluded that alcohol extract of *Solanum surattense* leaves possess significant antiulcer activity against experimentally induced ulcers in rats. There was an inhibitory effect on acid secretory mechanisms which may be due to the presence of the venal compounds. Further research to isolate antiulcer principle is needed.

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