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Gastro protective activity of *Momordica cymbalaria* fruits against experimentally induced gastric ulcer in rats

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Abstract

The effect of petroleum ether, chloroform and methanol extracts of unripe fruits of *Momordica cymbalaria* (Cucurbitaceae) was investigated in rats to evaluate the anti-ulcer activity by using three models, i.e. aspirin, alcohol and pyloric ligation induced gastric ulcer in rats. The parameters taken for assessing the anti-ulcer activity were volume of gastric secretion, PH, free acidity, total acidity and ulcer index. The results of the study revealed that the methanol extract of *Momordica cymbalaria* fruits had significantly ($P < 0.001$) reduced the volume of gastric acid secretion, PH, free acidity, total acidity and ulcer index with respect to control.

Keywords: *Momordica cymbalaria*, anti-ulcer, anti-secretory, gastro protective

Introduction

Peptic ulcer is the most common gastrointestinary disorder in clinical practice. Considering the several side effects (arrhythmia's, impotence, funaecomastia and haematopoeitic changes) of modern medicine [1], indigenous drugs possessing fewer side effects should be looked for as a better alternative for the treatment of peptic ulcer. There is evidence concerning the participation of reactive oxygen species in the etiology and pathophysiology of human diseases, such as neurodegenerative disorders, inflammation, viral infections, autoimmune pathologies and digestive system disorders such as gastrointestinal inflammation and gastric ulcer [2].

The study assumes significance in the context that prolonged use of synthetic anti-ulcer drugs leads to adverse drug reactions and a search for new anti-ulcer agents that retain therapeutic efficacy and are devoid of adverse drug reaction is warranted. A study of the efficacy of an extracts of *Momordica cymbalaria* in gastric ulcer with pylorus ligation, alcohol and aspirin-induced ulcer was undertaken in a rat model.

Momordica cymbalaria Hook f. is a wild crop, well known as *Athalakkai* in Tamil. The synonyms of *Momordica cymbalaria* are *Momordica tuberosa* Roxb. Cogn., *Luffa tuberosa* Roxb. It is available in various parts of India, and it is a highly acceptable wild vegetable across south India. The nutritional study of fruits of *Momordica cymbalaria* have reported that they possess a high level of calcium, potassium and vitamin C, in addition to its high crude fiber content [3]. The fruits of *Momordica cymbalaria* have been reported to possess hypoglycemic activity in rats [4, 5].

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The fruit extracts of *Momordica cymbalaria* were shown to have antidiabetic and hypolipidemic properties [6, 7]. The roots of this plant have been used by the natives of north Karnataka and Andhra Pradesh to treat some gynecological ailments and also to induce abortions [8]. The decoctions of *Momordica cymbalaria* fruits have been used in traditional medicine as a treatment for gastric ulcer. Although traditionally it is used for gastric ulcer, the plant has not been shown to possess antiulcer activity on the basis of scientific data.

Materials and Methods

Plant material: The plant material was collected in Aruppukottai surroundings of Virdhunagar district in Tamilnadu, India. It was authenticated by Dr. Kannan, Botanist, The Himalaya Drug Company, Bangalore. A voucher specimen of the plant was stored in the department of environmental and herbal sciences, Tamil University, Thanjavur, India. The plant was collected in the month of May 2008 and shade dried at room temperature (27^{o}C).

Extract Preparation

The unripe fruits along with seeds of MC (*Momordica cymbalaria)* were shade-dried and made into a coarse powder which was passed through a 40-mesh sieve to get a uniform particle size and then used for extraction. A weighed quantity (500 g) of the powder was then subjected to continuous hot extraction in Soxhlet apparatus with petroleum ether (60-80), chloroform and methanol and the residual marc was collected. The extract was filtered through a cotton plug, followed by Whatman filter paper (No.1). The extract was evaporated under reused pressure using a rotovac evaporator at a low temperature (40-60^{o}C) until all the solvent had been removed to give an extract sample with a yield of 16 % w/w, 14 %w/w and 12 % w/w in relation to the dried starting material. Preliminary Phytochemical analysis was carried out to identify presence of Phytoconstituents in the crude extract.

Preliminary phytochemical analysis

The various extracts of MC were then subjected to preliminary phytochemical analysis [9] to assess the presence of various phytoconstituents, it revealed that the presence of Alkaloids, Steroids, polyphenolic constituents like flavonoids, Quercetin, Saponins, glycosides. Preliminary Thin layer chromatography studies also confirmed these constituents [10].

Animals

Wistar albino rats weighing 150-200g of either sex maintained under standard husbandary conditions (temp 23±2^{o}C, relative humidity 55±10% and 12 hours light dark cycle) were used for the screening. Animals were fed with standard laboratory food and ad libitum during the study period. The experimental protocol has been approved by institutional animal ethics committee, Arulmigu Kalasalingam College of Pharmacy, Krishnankoil. (Regd No.412/01/C/CPCSEA/2002.) India.

Toxicity studies

Acute toxicity study was performed for various extracts of *Momordica cymbalaria* according to the acute toxic classic method as per OECD guidelines [11]. Female albino rats were used for acute toxicity study. The animals were kept fasting for overnight providing only water, after which the various extracts were administered orally at the dose of 300mg/kg and observed for 14 days. If mortality was observed in two animals out of three animals, then the dose administered was assigned as toxic dose. If the mortality was observed in one animal, then the same dose was repeated to confirm the toxic dose. If mortality was not observed, the procedure was repeated for further higher doses such 400,500 & 2000mg/kg body weight. The animals were observed for toxic symptoms for 72 h.

Aspirin-induced gastric ulcer

In the aspirin-induced ulcer experiments [12], three groups of albino rats (150–200 g), with each group consisting of six animals were used. The first group served as a control group, the second group served as positive control and the third group served as the test group. The second and third groups were treated respectively with Ranitidine (20 mg/kg) and petroleum ether, chloroform and methanol extracts of *Momordica cymbalaria* (100 & 200mg/kg), orally for 8 days. Control animals received normal saline (2 ml/kg) for 8 days. After 8 days of treatment, animals were fasted for 24 h. Ulcer was produced by administration of aqueous suspension of aspirin (a dose of 200 mg/kg orally) on the day of sacrifice. The animals were sacrificed 4 h later and stomach was opened to calculate the ulcer index by Kunchandy method [13].

Alcohol-induced gastric ulcer

The male rats were randomly divided into three groups and fasted for 24 h with free access to water. Animals were given vehicle or petroleum ether, chloroform and methnaol extracts of the *Momordica cymbalaria a*t a dose of 100 and 200 mg/kg or Ranitidine (20 mg/kg) orally. One hour later, 1 ml of 80% ethanol was administered orally to each animal [14]. Animals were sacrificed by cervical dislocation, one hour after ethanol administration, stomachs were isolated and cut open along the greater curvature and pinned on a soft board. The length of each gastric lesion was measured and the lesion index was expressed as sum of the length of the entire lesion in mm.

Pylorus- ligation induced gastric ulcer

Male albino rats weighing 150-200g were selected for pyloric ligation ulcer model [15]. Rats were divided into three groups, each group consisting of six animals. Animals were fasted for 24 h. One group received normal saline 2 ml/kg (negative control), the second group received Ranitidine 20 mg/kg by oral route (positive control) and the third group received petroleum ether, chloroform and methanol extracts of *Momordica cymbalaria* (100 & 200 mg/kg) by oral route, 30 min prior to pyloric ligation. Animals were sacrificed 4 h later and the stomach was opened to collect the gastric contents. The total volume of gastric content was measured. The gastric contents were centrifuged at 1000 rpm for 10 min. One ml of the supernatant liquid was pipette out and diluted to 10 ml with distilled water. The solution was titrated against 0.01N NaOH using Topfer's reagent as indicator, to the endpoint when the solution turned to orange colour. The volume of NaOH needed was taken as corresponding to the free acidity. Titration was further continued till the solution regained pink colour.

The volume of NaOH required was noted and was taken as corresponding to the total acidity. Acidity was expressed as:

$$\text{Acidity} = \frac{\text{Volume of NaOH x Normality x 100}}{0.1}\ \text{mEq/1.}$$

Statistical analysis:

The values Mean ± SEM are calculated for each parameter. For determining the significant inter group difference each parameter was analysed separately and one-way analysis of variance was carried out and the individual comparisons of the group mean values.

Results

Preliminary phytochemical screening revealed the presence of triterpenes, steroids, polyphenolic constituents like flavonoids, quercetin, saponins, glycosides, and tannins. Acute toxicity studies of the various extracts of the *Momordica cymbalaria* did not exhibit any signs of toxicity up to 2 g/kg body weight. Since there was no mortality of the animals found at high dose. Hence 100 and 200 mg/kg dose of the extract selected for evaluation of anti-ulcer activity.

Aspirin induced ulcer

Table 1 summarizes the results obtained in the experimental model of aspirin-induced gastric ulceration in rats. The methanol extract was

found to possess remarkable ulcer-protective properties at 100 and 200 mg/kg when compare to other two extracts. The maximum effect of ulcer protection 49.84 %, 57.84 % and 74.46 %, were produced at 200 mg/kg for petroleum ether, chloroform and methanol extracts of *Momordica cymbalaria*, and the standard drug (Ranitidine 20 mg/kg) gave 81.53% of ulcer protection (Table 1).

Alcohol induced ulcer

Pretreatment of rats with *Momordica cymbalaria* extracts produced a dose dependent protection in the ethanol induced ulceration model as compared to control group. However the protection was statistically significant reduced the severity of ulcer and caused a significant reduction of ulcer index in this model. Ranitidine produced significant gastric ulcer protection as compared to control group (Table 1).

Pylorus ligation induced ulcer

The petroleum ether, chloroform and methanol extracts of the *Momordica cymbalaria* in the doses of 100 and 200 mg/kg produced a reduction in the ulcer index, gastric volume, free acidity, total acidity and raised gastric pH significantly in comparison with control group. Ranitidine reference drug produced significant reduction gastric ulcer and total acid output as compared to control group (Table 2). The results of the present study indicate that the methanol extract of *Momordica cymbalaria* significantly reduces the total volume of gastric juice, free and total acidity of gastric secretion and also has activity against gastric ulcers in rats when compared to other two extracts (Figure 1). The control animals had ulcers and haemorrhagic streaks, whereas animals administered with the extracts of *Momordica cymbalaria* there was significant reduction in ulcer index ($P < 0.001$) (Figure 1).

Table 1:- Effect of various extracts of Momordica cymbalaria against Aspirin and Alcohol induced gastric ulcer in rats

Treatment	Dose (mg/kg) *p.o*	Aspirin		Alcohol	
		Ulcer Index	% of ulcer protection	Ulcer Index	% of ulcer protection
Control (Normal saline)	2ml/kg	6.5± 0.50	_	6.5± 0.50	_
Standard (Ranitidine)	20 mg/kg	1.20± 0.24	81.53	1.20± 0.24	81.53
Petroleum ether extract of MC	100mg/kg	4.92± 0.26	24.30	4.82± 0.28	25.84
	200mg/kg	3.30± 0.35	49.23	3.26± 0.26	49.84
Chloroform extract of MC	100mg/kg	4.60± 0.24	29.23	4.44± 0.27	31.69
	200mg/kg	2.86± 0.34	56.00	2.74± 0.31	57.84
Methanol Extract of MC	100mg/kg	4.20± 0.27	35.38	4.10± 0.24	36.92
	200mg/kg	1.74± 0.36	73.23	1.66± 0.34	74.46

Results are mean ± S.E.M.(n = 6). Statistical comparison was performed by using ANOVA coupled with student't' test.* P<0.05, ** P<0.01, *** P<0.001 were considered statistically significant when compared to control group.

Table 2:- Effect of various extracts of Momordica cymbalaria against Pylorus ligation induced gastric ulcer in rats

Treatment	Dose (mg/kg) p.o	Volume of gastric juice(ml/4 h)	PH	Free Acidity (mEq/L)	Total Acidity (mEq/L)	Ulcer Index	%Inhibition of ulcer
Control (Normal saline)	2ml/kg	4.02 ± 0.11	1.84 ± 0.14	26.84 ± 0.08	70.16 ± 0.30	3.68 ± 0.56	
Standard (Ranitidine)	20mg/kg	1.94 ± 0.06	4.96 ± 0.18	10.42 ± 0.02	22.24 ± 0.18	0.71 ± 0.14	80.70
Petroleum ether extract of MC	100mg/kg	3.92 ± 0.17	2.84 ± 0.16	24.84 ± 0.06	68.64 ± 0.39	2.84 ± 0.54	23.36
	200mg/kg	3.64 ± 0.14	3.18 ± 0.10	18.86 ± 0.02	42.58 ± 0.34	1.84 ± 0.52	50.00
Chloroform extract of MC	100mg/kg	3.74 ± 0.18	3.18 ± 0.16	20.84 ± 0.04	62.84 ± 0.42	2.50 ± 0.42	32.06
	200mg/kg	3.16 ± 0.16	3.86 ± 0.12	15.46 ± 0.02	38.54 ± 0.32	1.58 ± 0.46	57.06
Methanol Extract of MC	100mg/kg	3.62 ± 0.14	3.14 ± 0.15	22.16 ± 0.03	56.34 ± 3.16	2.32 ± 0.20	36.95
	200mg/kg	2.42 ± 0.18	4.52 ± 0.14	12.86 ± 0.04	32.46 ± 0.20	0.96 ± 0.22	73.91

Results are mean ± S.E.M. (n = 6). Statistical comparison was performed by using ANOVA coupled with student't' test.* P<0.05, ** P<0.01, *** P<0.001 were consider statistically significant when compared to control group.

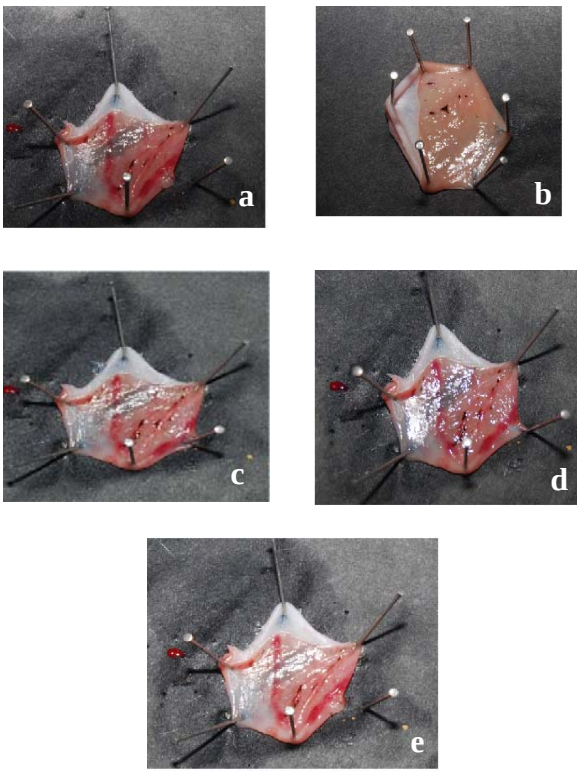

Fig. 1 Effect of various extracts of *Momordica cymbalaria* against aspirin induced gastric ulcer in rat
a, Stomach of control rat; b, standard drug treated; c, petroleum ether extract of MC treated; d, chloroform extract of MC treated; e, methanol extract of MC treated

Discussion

The anti-ulcer activity of the plant of *Momordica cymbalaria* was evaluated by employing asprin, alcohol and pylorus ligation ulcer models. These models represent some of the most common causes of gastric ulcer in humans. Many factors and mechanisms are implicated in the ulcerogenesis and gastric mucosal damage induced by different models employed in the present study involving, depletion of gastric wall, mucin mucosal damage induced by non-steroidal anti-inflammatory drugs and free radical production [14]. NSAID's like aspirin causes gastric mucosal damage by decreasing prostaglandin levels through inhibition of PG synthesis [15].

Methanol extract of the plant of *Momordica cymbalaria* was significantly effective in protecting gastric mucosa against aspirin induced ulcers at all the dose level studied. Ethanol

induced gastric injury is associated with significant production of oxygen free radicals leading to increased lipid peroxidation, which causes damage to cell and cell membrane [16]. The extracts of the *Momordica cymbalaria* has significantly protected the gastric mucosa against ethanol challenge as shown by reduced values of lesion index as compared to control group suggesting its potent cytoprotective effect. It has been proposed that in pyloric ligation, the digestive effect of accumulated gastric juice and interference of gastric blood circulation are responsible for induction of ulceration [17].

The antiulcer activity of *Momordica cymbalaria* extracts in pylorus ligation model is evident from its significant reduction in gastric volume, total acidity, free acidity, ulcer index and increase in pH of gastric juice. Because of animals treated with *Momordica cymbalaria* extracts significantly inhibited the formation of pylorus ulcer in the stomach and also decreased both acid concentration, gastric volume and increased the pH values. It is suggested that *Momordica cymbalaria* extracts can suppress gastric damage induced by aggressive factors.

It is generally accepted that gastric ulcers result from an imbalance between aggressive factors and the maintenance of the mucosal integrity through endogenous defence mechanisms [18]. The excess gastric acid formation by prostaglandin (PG) includes both increase in mucosal resistance as well as a decrease in aggressive factors, mainly acid and pepsin secretion [19]. Inhibitions of PG synthesis by aspirin coincide with the earlier stages of damage to the cell membrane of mucosal, parietal and endothelial cells [20]. The preliminary phytochemical studies revealed the presence of flavonoids and quercetin in methanol extract of *Momordica cymbalaria*; various flavonoids and quercetin have been reported for its anti-ulcerogenic activity with good level of gastric protection [21,22]. So the possible mechanism of gastro protective action of *Momordica cymbalaria* may be due to its flavonoid content [23,24]. In this study we observed that *Momordica cymbalaria* provides significant gastro protective activity against gastric ulcers in rats.

Conclusion

On the basis of the present results and available reports, it can be concluded that the gastro protective activity elucidated by fruits of *Momordica cymbalaria* could be mainly due to the modulation of defensive factors through an improvement of gastric cytoprotection and partly due to acid inhibition.

References

1. Akhtar MS, Khtar AH, Khan MA. Int. J Pharmacog. 1992; 30:97-8.
2. Repetto MG, Liesuy SF. Braz J Med Biol Res.2006; 35:523-34.
3. Parvathi S, Kumar VJ. Plant Foods Hum Nutr. 2002; 57:215-22
4. Rao BK, Kesavulu MM, Apparao C. J Ethnopharmacol. 2001; 78:67-71.
5. Kameswararao B, Kesavulu MM, Apparao C. Fitoterapia 2003; 74:7-13.
6. Rao BK, Kesavulu MM, Giri R, Appa Rao C. J Ethnopharmacol. 1999; 67:103-9.
7. Grover JK, Yadav S, Vats V. J Ethnopharmacol. 2002; 81:81-100.
8. Nadkarni AK, Indian Materia Medica, Popular Prakashan Private Ltd: Bombay, India; 1976. pp. 127.
9. Kokate CK, Practical Pharmacognosy, 3rd ed. 1991, Shri Dinesh K.Furia, Nirali Prakasham, Pune, pp. 128-123.
10. Wagner H, Bladts, E.N.Zgainski, Plant drug Analysis –A Thin Layer Chromatography Atlas 1984, Springer Yerlay berlin, New York, pp. 225-227.
11. Ecobichon DJ. The basis of toxicology testing 2nd ed., Newyork, CRC press, 1999; pp. 43-46.
12. Hegde DA, Khosa RL, Goel RK. Ancient Sci. Life, 1994; 14:77–81.

13. Kunchandy J, Khanna S, Kulkarni SK. Arch. Int. Pharmacodyn. 1985; 275: 123–138.
14. Hawk PB, Ostor BL Hawk's physiological chemistry. 14th ed. 1995, New York, Mc Graw Hill. pp. 128-30.
15. Shay H. Gastroenterology. 1945; 5: 43–61.
16. Bandyopadhyay U, Das D, Bandyopadhyay D, Bhattacharjee M, Banerjee RK. Current Science 1999; 76(1): 55-6.
17. Brodie DA. Am J Dig Dis 1966;11: 231-41.
18. Cheesman KH. Lipid peroxidation in biological systems in DNA and free radicals, edited by B Haliwell and OI Aruoma, 1993, Ellis Horwood, London. pp. 12.
19. Gordan MH. The mechanism of the anti-oxidant action in vitro. In B. J. F. Hudson, Food Anti-oxidants 1990, Elservier, London. pp. 1-18.
20. Szabo S, Szienji S. Trends Pharma Sci., 1987; 8:149–154.
21. Aly A. Scand J. Gastroenterology. 1987; 137:43–49.
22. Rainsford KD. Adv. Inflamm. Res., 1984; 6:51–64.
23. Alarcon DL, Martin MJ. Motilva V. J. Ethnopharmacol. 1994; 42:161–170.
24. Parmar NS, Parmar S. Indian J. Physiol. Pharmacol. 1998; 48:343–351.