

ORIGINAL ARTICLE

Evaluation of Gastro-protective Activity of Red-cabbage Against Indomethacin Induced Ulcer in Rats

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Abstract:

Background and objective: The red cabbage (*Brassica oleracea* Linn var. *capitata*) is a leafy green biennial plant that contains beta-carotene, vitamin C and fibre. It is used in cooking for its nutritional value and has known anti-inflammatory activity. This study compared the antiulcerogenic activity of Aqueous Extract of *Brassica* (AEB) *oleracea* var. *capitata* with Misoprostol. *Materials and Method:* Acute gastric ulcers were induced in albino rats by the oral administration of indomethacin. The gastroprotective potential of the AEB (250, 500 and 1000 mg/kg body weight) was compared with Misoprostol (100 µg/kg body weight). *Results:* A significant reduction in the mean number of lesions was observed in high dose AEB (0.83 ± 0.75) compared with indomethacin (4.00 ± 1.26). Mean number of lesions were similar in misoprostol groups (1.50 ± 0.55) and medium dose AEB (1.77 ± 0.41). No significant reduction in the mean number of lesions was observed in low dose AEB (3.00 ± 0.63) compared with indomethacin (4.00 ± 1.26). Inhibition percentage was maximum in high dose AEB (97.71%) and minimum in low dose AEB (28.08%). *Conclusions:* The AEB demonstrated good antiulcerogenic activities which justify the inclusion of this plant in the management of gastric disorders. Further experiments are underway to determine which anti-ulcer mechanisms involved in gastroprotection.

Key words: Anti-ulcer agents, Stomach ulcer, Brassica, Rats.

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Introduction:

The cabbage (*Brassica Oleraceae* var. *capitata*) is a herbaceous and leafy plant which belongs to the Brassicaceae family, native to coastal Southern and Western Europe. It presents a high versatility due to its nutritional value, being rich in calcium, protein and vitamin C and reported to use over ancient time in the healing of abscesses, internal ulcers and injuries among the Romans. Red cabbage is an annual leafy cruciferous vegetable with a dark reddish color, while green cabbage is green. Flavonoids, vitamins, and antioxidants make red cabbage healthier than green cabbage. Red cabbages taste pepperier and deeper than green cabbages.¹



Gastric ulcer is one of the most common gastrointestinal diseases, with a worldwide prevalence of nearly 11-14% in men and 8-11% in women.² The chronic administration of non-steroidal anti-inflammatory drugs (NSAIDs) is associated with developing peptic ulcers. Gastric injury following indomethacin ingestion is mediated by interference to prostaglandins production and their physiological actions. The acute lesions of the gastric mucosa are associated with the rupture of the hydrophobic surface of the membrane, injury and exfoliation of the epithelial surface with loss of barrier and electrical function, deep injury of the mucosal layer, including vascular endothelial cells and cell proliferation zone.³

One of the plants with the medical property in treating and preventing diseases is cabbage. Cabbage contains beta-carotene, vitamin C and fibre, and a significant amount of glutamine, an amino acid with anti-inflammatory properties.⁴ Cabbage contains S-methylmethionine, compounds with anti-ulcer properties that protect the gastric mucosal layer and aid in re-epithelializing the mucosal layer.⁵ Cheney confirmed that the patients who used the fresh cabbage juice achieved a healing effect on stomach ailments, especially for gastric ulcers.^{6,7}

Cabbage is consumed by most of the world's population without knowing its medicinal importance. It is prepared and consumed in a variety of ways. This study aimed to determine the gastroprotective effects of AEB against

indomethacin-induced gastric ulcers in rats.

Materials and method:

The study the gastro-protective activity of aqueous extract obtained from *Brassica oleracea* Linn var. *capitata* F. *rubra* (red cabbage) against indomethacin induced ulcer in rats. The experimental study was conducted in the Department of Pharmacology of Dhaka Medical College Hospital, Dhaka. Animals: A total of 30 Albino rats (150-200g) of both sex were used. Rats were kept at standard housing condition and fed with standard diet and water during the experiments. Red cabbage and drugs: red cabbage was obtained from local market and authenticated by National herbarium, Mirpur, Dhaka, Bangladesh. Aqueous extract was prepared from Centre for Advanced Studies and Research in Biological Science, University of Dhaka, Dhaka, Bangladesh. The administered different dose of red cabbage were 250mg/kg, 500mg/kg and 1000mg/kg body weight.⁴ Indomethacin and misoprostol were obtained from Dhaka Medical Hospital Pharmacy. Indomethacin was used as used for ulcer inducer whereas misoprostol was used as ideal gastroprotective agent to compared with red cabbage. The dose of indomethacin 100 mg/kg and misoprostol 100 µg/kg body weight⁷ were used daily in 2 dividing dose and calculated amount was dissolved and administered orally. Study design: The animals were divided in five groups and each group consist of six rats and received the treatment describe in table 1.

Table 1: Experimental design

Group	Red cabbage/Drug/Dose	Pre-treatment and duration	Indomethacin treatment	Evaluation
Gr-1	Indomethacin (100 mg/kg)	Tap water for 7 days	At day 7	Mean lesion (numbers, length)
Gr-2	Misoprostol (100 µg/kg)	Twice daily for 7 days	At day 7 after daily pre-treatment	
Gr-3	Red cabbage (250 mg/kg)	Twice daily for 7 days	At day 7 after daily pre-treatment	
Gr-4	Red cabbage (500 mg/kg)	Twice daily for 7 days	At day 7 after daily pre-treatment	Ulcer index
Gr-5	Red cabbage (1000 mg/kg)	Twice daily for 7 days	At day 7 after daily pre-treatment	Inhibition percentage

Mean number of lesions was maximum (4.00 ± 1.26) in Gr-1 and minimum (0.83 ± 0.75) in Gr-5. Mean number of lesions were variable in other Gr-2 (1.50 ± 0.55) Gr-3 (2.00 ± 0.63) and Gr-4 (1.77 ± 0.41). These difference was statistically significant ($F=29.58, p<0.01$)

Table 2: Effect of aqueous extract of red cabbage on mean lesion length

Group	Number of rats	Mean lesion lengths (\pm SD) in mm	95% CI	F	p value
Gr-1	6	3.72 ± 0.25	3.99-3.27	71.25	<0.01
Gr-2	6	1.80 ± 0.10	1.91-1.70		
Gr-3	6	2.17 ± 0.37	2.56-1.77		
Gr-4	6	1.70 ± 0.77	2.10-0.87		
Gr-5	6	1.00 ± 0.77	1.81-0.87		

Table II shows that mean lesions length was maximum (3.72 ± 0.25 mm) in Gr-1 and minimum (1.00 ± 0.77 mm) in Gr-5. Mean lesion lengths were variable in other Gr-2 (1.80 ± 0.10 mm) Gr-3 (2.17 ± 0.37 mm) and Gr-4 (1.70 ± 0.77 mm). These difference was statistically significant ($F=71.25, p<0.01$).

Table III: Effect of aqueous extract by red cabbage on ulcer index

Group	Number of rats	Ulcer index (\pm SD) in mm	95% CI		F	p value
Gr-1	6	14.83 ± 4.43	19.49	10.18	42.2	<0.01
Gr-2	6	1.75 ± 1.13	2.58	0.06		
Gr-3	6	3.25 ± 1.25	4.57	1.93		
Gr-4	6	2.67 ± 0.93	3.64	1.69		
Gr-5	6	1.25 ± 1.13	2.43	0.06		

Table III shows that ulcer index was maximum (14.83 ± 4.43 mm) in Gr-1 and minimum (1.25 ± 1.13) in Gr-5. Ulcer index were variable in other Gr-3 (1.75 ± 1.13 mm) Gr-3 (3.25 ± 1.25 mm) and Gr-4 (2.67 ± 0.93 mm) as well. These difference was statistically significant ($F=42.20, p<0.01$).

Table V: Effect of pretreatment by aqueous extract of red cabbage on Percent (%) inhibition in indomethacin induced rats

Groups	Number of rats	% Inhibition
Gr-1	6	-
Gr-2	6	91.57%
Gr-3	6	78.08%
Gr-4	6	82.00%
Gr-5	6	97.71%

TableV shows that percentinhibition was maximum in Gr-5 (97.71) and minimum in Gr-3 (78.08). Percent inhibition was variable in Gr-2 (91.57) and Gr-4 (82.00).

Discussion:

The present study evaluated the gastroprotective activity of red cabbage (*Brassica oleracea* L. var. *capitata* L. f. *rubra*) against indomethacin-induced ulcers in rats. It was observed that the *Brassica oleracea* extract (500 and 1000 mg/kg) and the positive control (misoprostol 100 micrograms/kg) significantly reduced all evaluated parameters compared to the control group ($p < 0.05$) in the indomethacin-induced group ulcer model. The 250 mg/kg dose showed no significant results. Ulcer inhibition was 82.00%, 97.71%, and 91.57% for the 500 and 1000 mg/kg *Brassica oleracea* and positive control (misoprostol) treated groups, respectively. These results demonstrate the anti-ulcer activity exhibited by the extract. Several studies suggested that red cabbage juice has a more significant gastroprotective effect.^{6,4}

The gastroprotective mechanism of red cabbage is that it has the parameters of gastric secretion, inhibition of (H⁺K⁺)-ATPase, reduction of HCl production, increase in endogenous prostaglandin level, antioxidant property, strengthening of the mucosa by the glucosinolate-related activity is impaired.⁸⁻¹⁰ Red cabbage contains a large amount of vitamin U, and vitamin C. Studies suggest that vitamin U and C play a crucial role in the gastric protective effect against histamine-induced ulcers.¹¹

Conclusion:

The present study determined that pre-treatment with red cabbage can prevent or reduce mucosal lesions induced by indomethacin. However, the current study was a pharmacological study where both the modern drug and herbal product were used to influence the biological system in a rat model. The biological system is affected by individual fluctuations. Therefore, more studies are needed to assess the level of anti-ulcer effects of natural honey in humans. Comparing the findings observed in different groups of rats, it was observed that red cabbage had a protective effect against indomethacin-induced gastric ulcer and the effect was potentiated in combination with misoprostol. Therefore, red cabbage can be used to protect the

gastric mucosa against ulcerogenic substances.

References:

1. Carvalho, C.A.D., Silva, M.B.D., Oliveira, T.G.D., Lima, J.D.M. and Rosa, M.B.D. Spectrometric study at different phenologic stages of the cabbage (*Brassica oleracea* var. *capitata*). *Revista Brasileira de Farmacognosia*, 2008; 18: 249-257.
2. Malfertheiner, P., Chan, F.K. and McColl, K.E., Peptic ulcer disease. *The Lancet* 2009; 374(9699): 1449-1461.
3. Aguwa, C.N., Incidence of gastric ulcers by indomethacin and piroxicam in rats. *Archives of toxicology*, 1985; 56(3): 212-213.
4. Okonkwo, C.O.J., Maduka, S.O., Onyebuchi, I. and Okwuonu, I. Antiulcerative Properties of Cabbage Juice on Indomethacin Induced Ulcer in Albino Rats. *Middle European Scientific Bulletin*, 2021; 13.
5. Ou, B., Huang, D., Hampsch-Woodill, M., Flanagan, J.A. and Deemer, E.K. Analysis of antioxidant activities of common vegetables employing oxygen radical absorbance capacity (ORAC) and ferric reducing antioxidant power (FRAP) assays: a comparative study. *Journal of agricultural and food chemistry*, 2002; 50(11): 3122-3128.
6. Lemos, M., Santin, J.R., Júnior, L.C.K., Niero, R. and de Andrade, S.F. Gastroprotective activity of hydroalcoholic extract obtained from the leaves of *Brassica oleracea* var. *acephala* DC in different animal models. *Journal of ethnopharmacology*, 2011; 138(2): 503-507.
7. Kim, T.H., Jeon, E.J., Cheung, D.Y., Kim, C.W., Kim, S.S., Park, S.H., Han, S.W., Kim, M.J., Lee, Y.S., Cho, M.L. and Chang, J.H. Gastroprotective effects of grape seed proanthocyanidin extracts against nonsteroid anti-inflammatory drug-induced gastric injury in rats. *Gut and liver*, 2013; 7(3): 282.
8. Tulassay, Z. and Herszényi, L. RETRACTED: Gastric mucosal defense and cytoprotection. *Best Practice & Research Clinical Gastroenterology*, 2010; 24(2): 99-108.
9. Moreno, D.A., Carvajal, M., López-Berenguer, C. and García-Viguera, C. Chemical and biological characterisation of nutraceutical compounds of broccoli. *Journal of pharmaceutical and biomedical analysis*, 2006; 41(5): 1508-1522.
10. Mullenix, P.J. A new perspective on metals and other contaminants in fluoridation chemicals. *International Journal of Occupational and Environmental Health*, 2014; 20(2): 157-166.
11. Cheney, G. Vitamin U therapy of peptic ulcer. *California Medicine*, 1952; 77(4): 248.