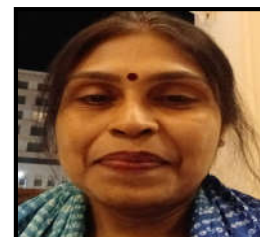


# Asian Journal of Research in Chemistry and Pharmaceutical Sciences

Journal home page: [www.ajrcps.com](http://www.ajrcps.com)

<https://doi.org/10.36673/AJRCPS.2023.v11.i02.A15>



## IN VITRO EVALUATION OF ANTACID AND ANTI-FLATULENT POTENCY IN AQUEOUS EXTRACT OF FENNEL SEEDS (*FOENICULUM VULGARE*), FENUGREEK SEEDS (*TRIGONELLA FOENUM-GRAECUM*) AND THEIR MIXTURE

Banani De\*<sup>1</sup> and Susmita Das<sup>1</sup>

<sup>1</sup>\*Department of Chemistry, Bijoy Krishna Girls' College, University of Calcutta, West Bengal, India.

### ABSTRACT

**Objective:** Antacids are popularly used throughout the world to address Gastric ulcer problems. In the present study aqueous extract of fennel seeds (*Foeniculum vulgare*), fenugreek seeds (*Trigonella foenum-graecum*) and 1:1 solution of these seeds are estimated of their antacid and antifatulence activity. **Methods:** The pH of aqueous extracts and their neutralizing properties on artificial gastric acids were determined and compared with water and among themselves. An artificial stomach was used to evaluate the duration of consistent neutralization effect on artificial gastric acids. The anti-flatulent activity was tested by creating foam with sodium laurethsulphate, and volume reduction of foam was calculated post addition of sample solutions. **Results:** The results showed that aqueous extract of both fennel and fenugreek seeds has considerable antacid and anti-flatulent. Compared to the water group, aqueous extract of seeds was found to have significant ( $P < 0.05$ ). Gastric acid neutralizing effects. The duration for consistent neutralization of fennel aqueous extract was significantly longer than the other sample solution. Moreover, these samples exhibited distinct anti-flatulent effects in *in vitro* model scoring marginally higher value for fenugreek. **Conclusion:** Both anti-acidic and anti-flatulence activity recorded by fennel extract in water and also by fenugreek highly corroborate with popular uses of these spices as ethnomedicine and can be recommend in different herbal formulation to cure peptic ulcer problems.

### KEYWORDS

*Foeniculum vulgare* Mill, *Trigonella foenum-graecum* L, Antacid, Anti-flatulent and Gastric juice.

### Author for Correspondence:

Banani De,  
Department of Chemistry,  
Bijoy Krishna Girls' College, West Bengal, India.

**Email:** bosenbanani@gmail.com

### INTRODUCTON

Antacids are group of drugs which act as a guard against peptic ulcer disease. Peptic ulcer, a gastrointestinal disorder usually occurs in the stomach and intestine area. The word "peptic" derives from the hormone pepsin that cause mucosal break. The common symptoms of peptic

ulcer disease are abdominal pain, nausea, vomiting, weight loss, bleeding etc<sup>1</sup>.

Major causes of peptic ulcer disease are gastric acid secretion, *H. pylori* infection, excess alcohol and tobacco consumption, non-steroidal anti-inflammatory drugs (NSAIDs)<sup>2,3</sup>. Treatment of peptic ulcer disease, in modern times involves drug therapy like proton pump inhibitor and H<sub>2</sub>-receptor<sup>4</sup>. The main motive of the treatment is to heal the sore, to relieve the epigastric pain and to prevent acid production. As well as to block the secretion of acid calcium supplement and some antacids like pantoprazole, metronidazole or amoxicillin are used<sup>5</sup>. There's lots of antacid available in market but due to the side effect, especially altered bowel functions, people often try to avoid it. Antacids are a combination of various compounds with various inorganic salts of magnesium, aluminum and calcium. Though aluminum antacids contribute aluminum to the diet, but also cause anemia and constipation. Magnesium antacids are very effective in raising gastric pH, but cause diarrhea due to poor absorption of insoluble magnesium. Calcium containing antacid inhibits peptic activity. The common side effects of this antacid are abdominal pain, milk-alkali syndrome, constipation<sup>6</sup>.

Traditional herbal medicines are often used to prevent the symptoms of peptic ulcer<sup>7</sup>. Some ethnomedicines for treatment of peptic ulcer are cabbage juice<sup>8</sup>, honey<sup>9</sup>, aloe vera<sup>10</sup>, turmeric<sup>11</sup>, chili peppers<sup>12</sup>.

Another important side effect of gastritis is flatulence which is a biological process and building up of gas in the digestive system during breaking down of food. The act of swallowing gas while eating and drinking may be a cause of flatulence<sup>13</sup>. Causes of flatulence are also bacterial overgrowth in small intestine, irritable bowel syndrome (IBS), celiac disease, complex carbohydrate, artificial sweeteners (sorbitol/mannitol) in sugar-free sweet foods<sup>14</sup>. Some of the symptoms are anorexia, early satiety, nausea. Therapies available for flatulence include lifestyle alteration, dietary modifications, adsorbents and agents which has surface tension

reducing property, treatments for gut flora and some drugs that modulate gut transit. Medicines or supplements are also recommended by doctors to reduce gas<sup>15</sup>. Some of ethnomedicines are natural substrates like chamomile, mint, basil, cumin, coriander, hyssop, arise, cinnamon, clove, bay, tarragon<sup>13</sup>.

Though some research is done with assorted spices and herbs, this study is focused on two common Indian spice viz. fennel, fenugreek seeds and their mixture (1:1 solution). Antiacidity and antifatulence activity of these spices and their mixture is evaluated in this study.

*Foeniculum vulgare* Mill. Commonly known as fennel belongs to the Apiaceae family<sup>16</sup>. This is used as traditional medicine. Fennel is abundant in carbohydrate and protein and also contains a small amount of fat, sugar, fiber, sodium, potassium, iron, magnesium, calcium, zinc, phosphorus. It contains Vitamin C, Vitamin A, Vitamin B-6, Vitamin E, Vitamin K, thiamin B-1, riboflavin B-2, phenylalanine, tryptophan, glycine, proline<sup>17</sup>. Phytoconstituents of fennel are anethole, fenchone, d- $\alpha$ -pinene, Anisic acid, Anisaldehyde<sup>18</sup>. This spice is used to control vomiting, diarrhea, dyspepsia, flatulence, stomach distension and gastrointestinal spasm, relieve pain, cause uterine contractions and stimulate the nerves. The pharmacological activities of the seeds reported are antimicrobial, antiaging, antiviral, antioxidant, antidiabetic, anti-inflammatory, antitumor, antiallergic, antistress, galactogenic, gastrointestinal effect, antipyretic, chemo preventive, hepatoprotective, hypoglycemic, hypolipidemic. Fennel helps to enhance memory, used as anesthetic, aphrodisiac, and insecticide<sup>19-24</sup>.

*Trigonal foenum-graecum* L. is known as fenugreek, belongs to Fabaceae family<sup>25</sup>. This is one of the oldest ethnomedicine. Fenugreek is ironic in fiber, phospholipids, glycolipids, carbohydrate, fat, protein, some aromatic compounds like butanoic acid, 3-isobutyl-2-methoxypyrazine, 1-octene-3-one, acetic acid, diacetyl, linoleic acid. Fenugreek seed is an abundant source of vitamin A, B1, B2, C, nicotinic acid, potassium, magnesium, calcium, zinc, manganese, copper, iron<sup>26-28</sup>. It has some bioactive constituents likediosgenin, 4-

hydroxyisoleucine (4-HIL), trigonelline, galactomannan (GM), polyphenols<sup>29</sup>. This traditional medicine has some pharmacological activity such as anti-diabetic agent, anti-bacterial, antioxidant, hypocholesterolemia, anti-fungal, anti-inflammatory, anti-ulcer<sup>30-32</sup>.

In this study, aqueous extract of fennel and fenugreek and their mixture (1:1) has been evaluated in terms Antiacidity and antifatulence activity to be used as an alternative in treatment of peptic ulcer. To estimate the anti-ulcer and anti-fatulence potential of the aqueous extracts on gastric acid, neutralization of the juice was performed *in vitro* and compared to water. Activity of the extract's solution (fennel, fenugreek and the mixture of both seeds) were also compared with each other.

## MATERIAL AND METHODS

### The Preparation of aqueous solution of fennel and fenugreek

Equal amount of two types of seeds namely fennel (5gm), fenugreek (5gm) and 5gm mixture (2.5gm+2.5gm) were taken separately and 50ml water was added to all. They were soaked in water over night and strained after 24 hours. Each aqueous extracts were made up to 100ml by subsequently adding water.

### Chemicals and Reagents

Pepsin was purchased from Apollo Pharmacy (Bhawanipur) and Fennel and fenugreek seeds were purchased from the local market of Howrah (kali babu bazar). And all the other chemicals were purchased from Merck Specialities Private Limited.

### Instruments

The experimental instruments consisted of an electrode stand, a pH meter, a stirrer and hot plate, burette and a graduated pipette.

### Preparation of Artificial Gastric Acid

Artificial gastric juice was prepared by adding 3gm of sodium chloride and dissolving 5mg of pepsin enzymes in 500mL water followed by adding 7.0mL hydrochloric acid and adequate water to make a 1000mL solution at pH 1.2.

### Determination of the Neutralizing Effects on Artificial Gastric Acids

22.5mL of each test solution was added to 25mL artificial gastric juices at pH 1.2. The pH values were determined to observe the neutralizing effect.

### Determination of the Duration of Consistent Neutralization Effect on Artificial Gastric Acids

22.5mL of each test sample was added to 25mL of artificial gastric juice at pH 1.2 in the beaker glass of the artificial stomach at 37°C and continuously stirred (60rpm) with magnetic stirring apparatus. Per minute 3mL of artificial gastric juice at pH 1.2 was pumped into the container of the artificial stomach, and it was pumped out at 3mL/min at the same time. A pH meter was connected to the artificial stomach to check the pH change of the gastric juice. The duration of neutralization effect was determined when the pH value was returned to its initial value (pH 1.2).

### Anti-flatulent Test in Removing Foam

50mL of gastric acid was taken a beaker in and 0.938gm sodium laureth sulphate was subsequently added into it. The mixture was heated at 37°C with stirrer speed of 120 rpm to form foam. The volume of foam formed was measured. Then, 10mL of sample solutions were added. The mixtures were observed within 20 minutes and the remaining volume of foams were measured.

### Statistical analyses

All the experiments have been done in triplicate. And data from three different experiments were subjected to analysis of variance (ANOVA) ( $P < 0.05$ ).

## RESULTS AND DISCUSSION

### Anti acid Activity Test

The duration for consistent neutralizing effect of aqueous extract of fennel, fenugreek and the mixture (1:1 solution) of the seeds recorded were 34 minutes, 24 minutes, 33 minutes, respectively and the water was 23minutes.

In this present study we had applied a titration method which mimics the regular physiological functioning of a human stomach, to explore the anti-acidic effects of fennel and fenugreek seeds that were well known for its efficiency to cure

gastric ulcer. Fennel and fenugreek seeds aqueous extract have antacid and anti-flatulent activities. The anethole and fenchone inside fennel were expected to have antacid and anti-flatulent activity. In the case of fenugreek, it included polyphenol group that has PKa of 10.19, thus it was considered as a weak base. Like an antacid the polyphenol group has the same mechanism while reacting with hydrochloric acid and hence neutralizing gastric acid. Here among the four samples (aqueous extract of fennel, aqueous extract of fenugreek, and 1:1 solution of two extracts and water), fennel showed the best result on anti-acidic test. When the fennel extract added, the pH of gastric juice had reached 1.79 and took 34 minutes to come back the initial pH (1.2). In case of fenugreek pH reached 1.51 and took 24 minutes. PH reached 1.62 for the 1:1 solution and took 33 minutes and water took 23 minutes to come back the initial pH from pH 1.2. Thus, fennel and fenugreek seeds exhibited gastric acid neutralizing potential of the most efficient is fennel.

Anti-flatulent test was also performed by checking the ability to reduce foam forming tendency. The reduction of volume of foam was observed. Fennel extract reduced 20.00019114% foam whereas fenugreek extract reduced 20.00020206% foam. 1:1 solution reduced foam by 18.51926704% for and water by 15.9993534%. Fennel and fenugreek both showed almost similar result in the test of anti-flatulent.

Thus, it can be concluded that fennel and formulations of fennel can be used as herbal drugs to prevent peptic ulcer and flatulent.

**Table No.1: Anti acid activity test**

S.No	Test solution	pH after adding the solution	duration of neutralizing (minutes)
1	Fennel extract	1.79	34
2	Fenugreek extract	1.51	24
3	Mix (1:1 sol)	1.62	33
4	Water	1.48	23

**Table No.1: Anti-flatulent activity test**

S.No	Test solution	Initial vol of foam (cm <sup>3</sup> )	Final vol of foam (cm <sup>3</sup> )	Reduced vol(cm <sup>3</sup> )	% of reduction
1	Fennel extract	104.634	83.707	20.927± 0.201	20.00019114 ± 0.201
2	Fenugreek extract	98.979	79.183	19.796 ± 0.193	20.00020206 ± 0.193
3	Mix (1:1 sol)	103.908	84.665	19.243 ± 0.197	18.51926704 ± 0.197
4	Water	98.979	83.143	15.836 ± 0.155	15.9993534 ± 0.155

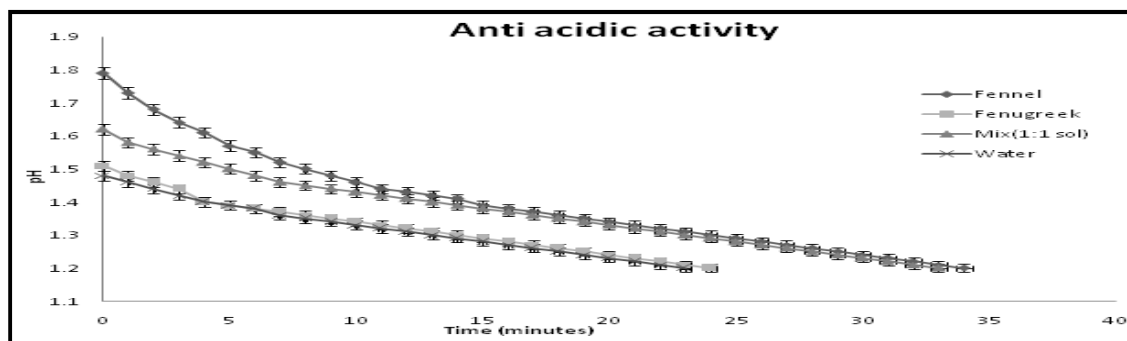


Figure No.1: The duration of anti-acidic effect of the seeds for consistent neutralization of gastric acids

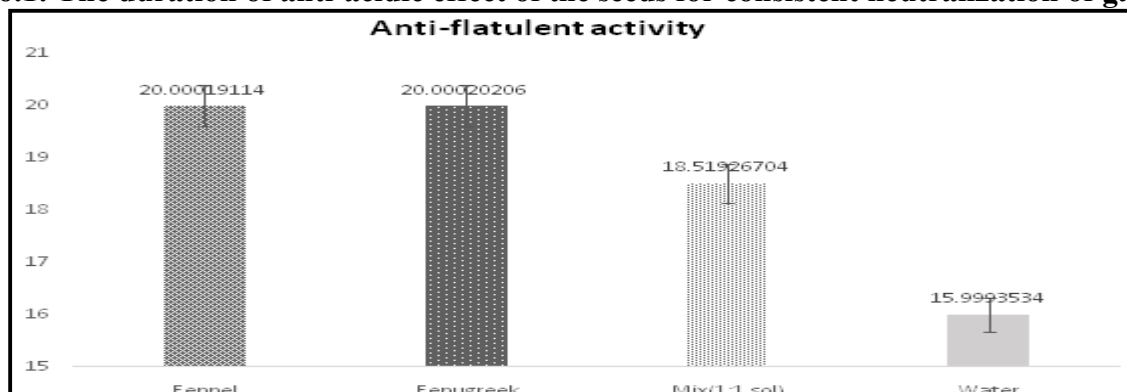


Figure No.2: % of remaining volume foam within 20minutes

## CONCLUSION

This present study revealed significant anti-acidic and anti-flatulent activities in aqueous extract of fennel seeds and fenugreek seeds and also in their 1:1 mixture in the *in vitro* models tested. Results clearly indicate higher antacid potential of fennel compared to fenugreek. Anti-flatulent activity of both fennel and fenugreek was found to be similar (marginally higher for fenugreek) though the 1:1 recorded less. These observations claim further probe into the exact determination of the constituents responsible for these activities in particular. More research can help to find out dosage and exact proportion of effective formulation and other also with other extracts to cure gastric ulcer problems.

## ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to Department of Chemistry, Bijoy Krishna Girls' College, University of Calcutta, West Bengal, India for providing necessary facilities to carry out this research work.

## CONFLICT OF INTEREST

We declare that we have no conflict of Interest.

## BIBLIOGRAPHY

1. Ahmed M, X Qi, S Koruth. Peptic ulcer disease, Digestive system - Recent advances, *Intech Open*, 2019, 1-20.
2. Sostres C, Carrera P, Benito R, Roncales P, Arruebo M, Arroyo M T, Bujanda L, Garcia-Rodriguez L A, Lanas A. Peptic ulcer bleeding risk, the role of helicobacter pylori infection in NSAID/low-dose aspirin users, *The American Journal of Gastroenterology*, 110(5), 2015, 684-689.
3. Kuna L, Jakab J, Smolic R, Raguz-Lucic N, Vcev A, Smolic M. Peptic Ulcer disease: A brief review of conventional therapy and herbal treatment options, *Journal of Clinical Medicine*, 8(2), 2019, 179-198.
4. Narayanan M, Reddy K M, Marsicano E. Peptic ulcer disease and helicobacter pylori infection, *Missouri Medicine*, 115(3), 2018, 219-224.

5. Malfertheine P, Megraud F, Bazzoli F, Gasbarrini A, Atherton J, Graham D Y, Hunt R, Moayyedi P, Rokkas T, Rugge M, Selgrad M, Suerbaum S, Sugano K, El-Omar E M. Management of helicobacter pylori infection-the maastricht v/florence consensus report, *GUT*, 66(1), 2017, 6-30.
6. Mishra E, Shetty N, Waghmare M. Antacid: An overview, *International Journal of Recent Scientific Research*, 12(4), 2021, 41448-41453.
7. Ardalani H, Hadipanah A, Sahebkar A. Medicinal plants in the treatment of peptic ulcer disease: A review, *Mini-Reviews in Medicinal Chemistry*, 20(8), 2020, 662-702.
8. Cheney G. Vitamin U therapy of peptic ulcer, *World Journal of Methodology*, 77(4), 1952, 248-252.
9. Ali A T, Chowdhury M N. Inhibitory effect of natural honey on helicobacter pylori, *Tropical Gastroenterol*, 12(3), 1991, 139-143.
10. Werawatganon D, Rakananurak N, Sallapant S, Prueksapanich P, Somanawat K, Klaikeaw N, Rerknimitr R. Aloe vera attenuated gastric injury on indomethacin-induced gastropathy in rats, *World Journal of Gastroenterology*, 20(48), 2014, 18330-18337.
11. Yadav S K, Sah A K, Jha R K, Sah P, Shah D K. Turmeric (curcumin) remedies gastroprotective action, *Pharmacognosy Review*, 7(13), 2013, 42-46.
12. Satyanarayana M N. Capsaicin and gastric ulcers, *Critical Reviews in Food Science and Nutrition*, 46(4), 2006, 275-328.
13. Larijani B, Esfahani M M, Moghimi M, Ardakani M R S, Kenari H M, Zargaran A. Prevention and Treatment of Flatulence From a traditional persian medicine perspective, *Iranian Red Crescent Medical Journal In Press (In Press)*, 18(4), 2016, 23664.
14. Lacy B E, Cangemi D, Roque M V. Management of chronic abdominal distension and bloating, *Clinical Gastroenterology and Hepatology*, 19(2), 2020, 219-231.
15. Schmulson M, Chang L. The treatment of Functional Abdominal Bloating and Distension, *Alimentary Pharmacology and Therapeutics*, 33(10), 2011, 1071-1086.
16. Rather M A, Sofi S N, Bhat B A, Qurishi M A. *Foeniculum vulgare*: A comprehensive review of its traditional use, phytochemistry, pharmacology and safety, *Arabian Journal of Chemistry*, 9(2), 2016, S1574-S1583.
17. Badgujar S B, Bandivdekar A H. *Foeniculum vulgare mill*: A review of its botany, phytochemistry, pharmacology, contemporary application and toxicology, *BioMed Research International*, 2014(4), 2014, 32.
18. Alam P, Abdel-Kader M S, Shakeel F. Chemical composition of fennel seed extract and determination of fenchone in commercial formulations by GC-MS method, *Journal of Food Science and Technology*, 56(5), 2019, 2395-2403.
19. Marino S D, Gala F, Borbone N, Zollo F, Vitalini S, Visioli F, Iorizzi M. Phenolic Glycosides from *Foeniculum vulgare* fruit and evaluation of antioxidative activity, *Phytochemistry*, 68(13), 2007, 1805-1812.
20. Ozbek H, Ugras S, Dulger H, Bayram I, Tuncer I, Ozturk G, Ozturk A. Hepatoprotective effect of *foeniculum vulgare* essential oil, *Fitoterapia*, 74(3), 2003, 317-319.
21. Choi E M, Hwang J K. Antiinflammatory, Analgesic and antioxidant activities of the fruit of *foeniculum vulgare*, *Fitoterapia*, 75(6), 2004, 557-565.
22. El-Soud N A, El-Laithy N, El-Saeed G, Wahby M S, Khalil M, Morsy F, Shaffie N. Antidiabetic activities of *foeniculum vulgare mill*, essential oil in streptozotocin-induced diabetic rats, *Macedonian Journal of Medical Sciences*, 4(2), 2011, 139-146.
23. Kwon Y S, Choi W G, Kim W J, Kim W K, Kim M J, Kang W H, Kim C M. Antimicrobial constituents of *Foeniculum vulgare*, *Archives of Pharmacal Research*, 25(2), 2002, 154-157.

24. Koppula S, Kumar H. *Foeniculum vulgare* Mill (umbelliferae) attenuates stress and improves memory in wister rat, *Tropical Journal of Pharmaceutical Research*, 12(4), 2013, 553-558.
25. Flammang A M, Cifone M A, Erexson G L, Stankowski L F. Genotoxicity testing of a fenugreek extract, *Food and Chemical Toxicology*, 42(11), 2004, 1769-1775.
26. Yusharyahya. Potential role of fenugreek (*Trigonella foenumgraecum*) in the prevention of skin aging, *Journal of the Medical Sciences*, 53(1), 2021, 78-86.
27. Sulieman A M E, Ali A O, Hemavathy J. Lipid content and fatty acid composition of fenugreek (*trigonellafoenum-graecum l.*) seeds grown in Sudan, *International Journal of Food Science and Technology*, 43(2), 2006, 380-382.
28. Chatterjee S, Variya P S, Sharma A. Bioactive lipid constituents of fenugreek, *Food Chemistry*, 119(1), 2010, 349-353.
29. Srinivasa U, Naidu M. Fenugreek (*Trigonella foenum-graecum L.*) seed: Promising source of nutraceutical, *Studies in Natural Products Chemistry*, 71, 2021, 141-184.
30. Xue W L, Li X S, Zhang J, Liu Y H, Wang Z L, Zhang R J. Effect of *trigonella foenum-graecum* (fenugreek) extract on blood glucose, blood lipid and hemorheological properties in streptozotocin-induced diabetic rats, *Asia Pacific Journal of Clinical Nutrition*, 16(1), 2007, 422-426.
31. Al-Timimi L A N. Antibacterial and anticancer activities of fenugreek seed extract, *Asian Pacific Journal of Cancer Prevention: APJCP*, 20(12), 2019, 3771-3776.
32. Pundarikakshudu K, Shah D H, Panchal A H, Bhavsar G C. Anti-inflammatory activity of fenugreek (*trigonella foenum-graecum linn*) seed petroleum ether extract, *Indian Journal of Pharmacology*, 48(4), 2016, 441-444.

**Please cite this article in press as:** Banani De and Susmita Das. *In vitro* evaluation of antacid and anti-flatulent potency in aqueous extract of fennel seeds (*foeniculum vulgare*), fenugreek seeds (*trigonella foenum-graecum*) and their mixture, *Asian Journal of Research in Chemistry and Pharmaceutical Sciences*, 11(2), 2023, 107-113.