IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Formulation And Evaluation Of Herbal Digestive Churna

Mr. Zumbar Rajendra Dhaygude[1], Ms. Pratiksha Shamrao Avhad[1],

Dr. Amol Navnath Khedkar*[2]

[1]Student of final year B. Pharmacy, Saikrupa Institute of Pharmacy, Ghargaon, Shrigonda, Ahilyanagar, Maharashtra, India 413728.

[2] Professor and Principal, Saikrupa Institute of Pharmacy, Ghargaon, Shrigonda, Ahilyanagar, Maharashtra, India 413728.

Abstract:

Digestive disorders are common due to irregular eating habits and stress, prompting a shift toward herbal remedies. The present study focuses on the formulation and evaluation of a digestive churna (powder) incorporating traditionally known carminative and digestive ingredients: guava leaves (Psidium guajava), cumin seeds (Cuminum cyminum), fennel seeds (Foeniculum vulgare), and carom seeds (Trachyspermum ammi). These ingredients were shade-dried, powdered, and blended in optimized proportions to create the churna.

Pre-formulation studies included organoleptic evaluation, phytochemical screening, and compatibility tests. The final formulation was evaluated for parameters such as flow properties (angle of repose, bulk density, tapped density, Carr's index, and Hausner ratio), moisture content, and microbial load. In-vitro digestion simulation and assessment of digestive enzyme activity were also performed to evaluate efficacy.

The results demonstrated that the formulation had acceptable physicochemical properties and showed significant enhancement in digestive enzyme activity, particularly amylase and lipase. Preliminary phytochemical analysis confirmed the presence of flavonoids, tannins, alkaloids, and essential oils, which may contribute to the formulation's therapeutic effects. In conclusion, the formulated churna exhibited promising digestive properties and can serve as a +natural, effective alternative for managing indigestion and related gastrointestinal discomforts.

Herbal formulations have gained popularity for their efficacy and minimal side effects in managing digestive disorders. This study involves the formulation and evaluation of a polyherbal digestive churna composed of guava leaves (Psidium guajava), cumin seeds (Cuminum cyminum), fennel seeds (Foeniculum vulgare), and carom seeds (Trachyspermum ammi), each known for their traditional use in gastrointestinal health.

Keywords:

Digestive churna, Guava leaves, Cumin seeds, Fennel seeds, Carom seeds, Herbal formulation.

Introduction:

The prevalence of digestive disorders such as indigestion, bloating, flatulence, and constipation has significantly increased due to modern lifestyle factors, including irregular eating habits, consumption of processed foods, stress, and lack of physical activity. While allopathic medicines provide symptomatic relief, long-term usage may lead to side effects. This has led to a renewed interest in herbal and Ayurvedic remedies, which are generally safer, more holistic, and cost-effective.

Churna is a traditional Ayurvedic powdered formulation composed of one or more herbs, widely used to promote digestion and improve gastrointestinal health. The preparation method preserves the natural bioactive compounds of the herbs, allowing for easy absorption and effectiveness. Churna formulations are especially popular for their simplicity, affordability, and rapid onset of action when taken with water or honey.

The present study aims to formulate a polyherbal digestive churna using four key ingredients: guava leaves (Psidium guajava), cumin seeds (Cuminum cyminum), fennel seeds (Foeniculum vulgare), and carom seeds (Trachyspermum ammi). These botanicals have been traditionally recognized for their therapeutic benefits in treating digestive ailments. Guava leaves possess antimicrobial and anti-inflammatory properties and are rich in tannins and flavonoids, aiding in gut health. Cumin seeds stimulate digestive enzymes and reduce bloating. Fennel seeds are known for their carminative and antispasmodic actions, while carom seeds help in relieving indigestion and gas due to their thymol content.

This study focuses on the systematic formulation of the churna and its evaluation based on organoleptic properties, physicochemical parameters, flow properties, microbial load, and in-vitro digestive enzyme activity. The goal is to develop a safe, effective, and natural digestive aid that supports both traditional knowledge and modern scientific validation.

Digestive churna has a rich history rooted in Ayurveda, the ancient Indian system of medicine that dates back over 3,000 years. The term "churna" means powder in Sanskrit, and digestive churna refers to a powdered blend of herbs and spices used to support digestion. Early Ayurvedic texts like the Charaka Samhita and Sushruta Samhita describe various churnas made from natural ingredients such as cumin, ginger, black pepper, ajwain, and hing (asafoetida), all known for their digestive and carminative properties. These churnas

were traditionally prepared at home or by Ayurvedic practitioners and used to balance the body's doshas and stimulate digestive fire, or agni. Over time, specific formulations like Trikatu Churna and Hingwashtak Churna became popular remedies for common digestive problems. In the modern era, with the rise of Ayurvedic product companies, digestive churnas became widely available in commercial forms like powders, tablets, and flavored candies. Today, they remain a popular natural remedy for digestive health, blending ancient wisdom with contemporary wellness practices.[30,28,21,1,11,12]

Advantages of Digestive Churna:

Digestive churna (a traditional Ayurvedic herbal powder) is used to support digestion and overall gastrointestinal health. Here are some common advantages:

1. Improves Digestion: It stimulates the digestive fire (agni), helping break down food more efficiently and reducing indigestion.

2. Relieves Gas and Bloating: Ingredients like ajwain, hing, and cumin help expel gas and reduce abdominal discomfort.

3. Prevents Constipation: Many churnas support regular bowel movements by improving intestinal motility.

4. Reduces Acidity: Some formulations balance excess stomach acid and soothe the digestive tract.

5. Enhances Appetite: By stimulating digestive enzymes, it can help boost appetite, especially after illness.

6. Natural and Herbal: Made from time-tested herbs and spices, it is generally free from harmful chemicals and preservatives.

7. Balances Doshas: According to Ayurveda, it helps maintain harmony among the body's three doshas – Vata, Pitta, and Kapha.

8. Improves digestion: It stimulates digestive enzymes and helps break down food more efficiently.

9. Relieves gas and bloating: Ingredients like hing (asafoetida) and ajwain reduce flatulence.

10. Eases constipation: Herbs like haritaki and senna can promote regular bowel movements.

11. Reduces acidity: Helps balance stomach acid and may prevent acid reflux or heartburn.

12. Enhances appetite: Useful for those with poor appetite due to weak digestion.[23,2,8,14,33]

Ideal Qualities of Digestive Churna:

1. Enhances Digestion – Stimulates digestive fire (Agni) and improves overall digestion.

2. Relieves Gas and Bloating – Acts as a carminative to reduce flatulence and abdominal discomfort.

3. Natural and Herbal – Made from safe, time-tested herbs like ginger, cumin, ajwain, and black pepper.

4. Palatable and Easy to Use – Tasty, with a balanced flavor, and convenient for regular use.

5. Balances Doshas – Helps maintain Vata and Kapha balance for optimal gut health.[3,4,22,27,32,]

Drugs and Excipients Profile:S

1.Guava Leaves:

Fig No. 1 Guava Leaves

Synonyms: Psidium guajava leaves, Guava leaf extract, Guajava folium (Latin name).

Scientific Name: Psidium guajava.

Biological Source: This plant species belongs to the family Myrtaceae and is the source of guava leaves, which are used in traditional medicine, herbalism, and other applications.

Family: Myrtaceae.

Geographical Source: Tropical regions of Central and South America, the Caribbean, and parts of Asia, India, China, Brazil, Mexico, Southeast Asia (e.g., Thailand, Indonesia, Vietnam).

Microscopic Characteristics:

Colour: Dark green on the upper surface; pale green or lighter on the underside.

Odor: Characteristic aromatic, slightly musty or herbal smell, noticeable when crushed.

Taste: Slightly astringent, mildly bitter and herbal.

Size: Length: 5–15 cm, Width: 3–7 cm.

Shape: Oval to elliptic or oblong; leaf base rounded to obtuse; apex acute to obtuse; margin entire or slightly serrate (toothed); simple, opposite leaves with prominent reticulate venation.

Chemical Constituents:

1. Phytochemicals: Flavonoids, Phenolic Acids, Triterpenoid.

2. Essential Oils: Major Constituents- 1,8-Cineole, trans-Caryophyllene, α-Pinene, Limonene.

Uses:

Medicinal Uses:

1. Digestive issues: Treating diarrhea, dysentery, and gastroenteritis.

2. Antibacterial and antifungal: Effective against various bacterial and fungal infections.

3. Anti-inflammatory: Reducing inflammation and pain.

4. Antioxidant: Protecting against oxidative stress and cell damage.

Traditional Uses:

1. Herbal tea: Making tea for digestive issues, fever, and respiratory problems.

2. Wound healing: Applying crushed leaves to wounds.

3. Skin and hair care: Using leaves in face masks, hair treatments, or skin toners.

Other Uses:

1. Food: Using leaves in traditional dishes or as a spice.

2. Cosmetic: Incorporating leaves into skincare products.

3. Pharmaceutical: Studying guava leaf extracts for potential therapeutic applications.[20,21,25,26,31]

2. Fennel Seed:

Fig No.2 Fennel Seeds

Synonyms: Saunf (common in India), Sweet fennel, Foeniculum, wild fennel.

Scientific Name: Foeniculum vulgare.

Biological Source: Foeniculum vulgare.

Family: Apiaceae.

Geographical Sources:

1. Mediterranean region: Countries like Italy, Greece, and Turkey are known for their fennel cultivation.

2. India: Fennel is widely cultivated in India, particularly in states like Gujarat, Rajasthan, and Madhya Pradesh.

3. China: China is also a significant producer of fennel seeds.

4. Egypt: Egypt is another country where fennel is cultivated for its seeds.

Microscopic Characteristics:

Colour: Greenish-yellow to yellowish-brown, High-quality seeds are more greenish (indicates freshness).

Odor: Aromatic, sweet, and pleasant. Resembles anise due to the presence of anethole.

Taste: Sweet, licorice-like, mildly spicy, refreshing aftertaste.

Size: Length: 4–8 mm, Width: 1–2 mm.

Shape: Crescent-shaped or oblong.

Chemical Constituents:

1. Volatile (Essential) Oil (~1.5–6%)

Anethole (50–70%) – sweet flavor, antispasmodic

Fenchone – bitter, aromatic, digestive stimulant

Estragole (methyl chavicol) – sweet, contributes to aroma

Limonene – citrus scent, antioxidant

α-Pinene, myrcene, camphene – minor components.

2. Fixed Oil (~10–15%)

Contains oleic, linoleic, and palmitic acids.

3. Proteins and Amino Acids

Present in the seed endosperm.

4. Flavonoids

Quercetin, kaempferol, rutin – antioxidant and anti-inflammatory activity.

5. Phenolic Compounds.

Uses:

Culinary Uses:

1. Spice and flavoring: Adding flavor to dishes, particularly in Indian, Mediterranean, and Middle Eastern cuisine.

2. Digestive aid: Chewing fennel seeds to alleviate digestive issues.

Medicinal Uses:

1. Digestive issues: Treating bloating, gas, indigestion, and other digestive problems.

2. Antioxidant and anti-inflammatory: Potential health benefits due to antioxidant and anti-inflammatory properties.

Other Uses:

1. Herbal tea: Making tea from fennel seeds for digestive issues or relaxation.

2. Aromatherapy: Using fennel essential oil in aromatherapy for its potential benefits.[18,19,20,29,35]

3. Cumin Seed:

Fig No. 3 Cumin seeds

Synonyms: Jira, Cuminum cyminum, Roman Cumin, Black Cumin.

Scientific Name: Cuminum cyminum L.

Biological Source: It consists of dried ripe fruits of Cuminum cyminum Linn.

Family: Umbelliferae.

Geographical Source:

1. India – Largest producer and consumer, especially Rajasthan, Gujarat, and Madhya Pradesh

2. Middle East – Countries like Iran, Syria, Turkey, and Egypt

3. Mediterranean region – Including Spain and Italy

4. North Africa – Morocco and Tunisia

5. China – Also a significant producer

6. Mexico – Cultivated in some regions for local use and export.

Macroscopic Characters:

Color: Brown coloured ridges are light in colour.

Odor: characteristics and aromatic.

Taste: characteristics and aromatic.

Size: 4-6mm in length and 2 mm thick.

Shape: elongated and tapering at both ends cremocarps generally separate each mericarp has fine

longitudinal ridges.

Chemical constituents: Cummin fruits contain 2.5-4 per cent volatile oil, 10 per cent fixed oil and proteins volatile oilmainly consist of 30-50 per cent cuminaldehyde small quantities of phellandrene cuminic alcohol, hydrated cuminaldehyde and hydro-cumimine.

Uses: Stimulant carminative, Diarrhoea dyspepsia, blood sugar regulation. [5,15,16,17,24,25,33]

4. Carom Seed:

Fig No. 4 Carom Seeds

Synonyms: Ajwain, Bishop's weed, Caraway seeds, Lovage seeds.

Scientific Name: Trachyspermum ammi.

Biological Source: Trachyspermum ammi.

Family: Apiaceae.

Geographical Source:

1. India: Widely cultivated in India, particularly in states like Rajasthan, Gujarat, and Madhya Pradesh.

2. Middle East: Countries like Iran, Egypt, and Afghanistan also cultivate carom seeds.

Microscopic Characters:

Color: Brown or brownish-green: Carom seeds are typically brown or brownish-green in color.

Odor: Pungent, thyme-like: Carom seeds have a distinctive, pungent aroma, often compared to thyme.

Taste: Bitter, pungent, slightly sweet: The taste of carom seeds is bitter, pungent, and slightly sweet.

Size: Small: Carom seeds are relatively small, typically around 2-3 mm in length.

Shape: Ovoid or egg-shaped: Carom seeds are ovoid or egg-shaped, with a distinctive ridged or striated surface.

Chemical Constituent: Essential Oils Thymol, Carvacrol, p-Cymene, **Other Compounds** Flavonoids, Phenolic acids, Saponins, **Nutrients** Dietary fiber, Minerals calcium, iron, potassium.

Uses:

Culinary Uses: Spice and flavoring: Adding flavor to dishes, particularly in Indian and Middle Eastern cuisine.

Digestive aid: Chewing carom seeds to alleviate digestive issues.

Medicinal Uses: Digestive issues: Treating bloating, gas, indigestion, and other digestive problems.

Antimicrobial and antifungal: Potential health benefits due to antimicrobial and antifungal properties.

Traditional Medicine: Ayurvedic and Unani medicine: Carom seeds are used in traditional medicine to treat various ailments.

Other Uses: Aromatherapy: Using carom seed essential oil in aromatherapy for its potential benefits.[6,7,8,10,33]

Material and Methods:

Materials:

Material are use for formulation Guava Leaves, Fennel Seeds, Cumin Seeds, Carom Seeds are collect a garden and Local marker.

Fig.No. 5 Guava Leaves Powder

Fig. No. 6 Fennel Seeds Powder

Fig.No. 7 Cumin Seeds Powder

Fig.No. 8 Carom Seeds Powder

Ingredient & Key Compounds:

Tabel 1. Ingredient & Key Compounds

Ingredient	**Key Compounds**
Guava Leaves	Flavonoids (quercetin), tannins, saponins, essential oils.
Fennel Seeds	Anethole, flavonoids, essential oils (limonene, fenchone).
Cumin Seeds	Thymol, carvacrol, terpenes.
Carom Seeds	Cuminaldehyde, thymol, terpenes, flavonoids.

Extraction process by Evaporation Method:

1. **Guava Leaves:** The Solution was prepared according to formula take 25gm powder of guava leaves then 100ml water and heating at 60 degree temperature and them and mash the powder.
2. **Cumin seeds:** The Solution was prepared according to formula take 10gm powder of guava leaves then 50ml water and heating at 60 degree temperature and them and mash the powder.
3. **Carom Seeds:** The Solution was prepared according to formula take 10gm powder of guava leaves then 50ml water and heating at 60 degree temperature and them and mash the powder.
4. **Fennel Seeds:** The Solution was prepared according to formula take 10gm powder of guava leaves then 50ml water and heating at 60 degree temperature and them and mash the powder.[9,13]

Fig.No. 9 Heating Mantles

Formulation of Powder:

Tabel 2. Formulation Tabel

Sr. No.	Ingredients	F1	F2	F3	F4
1.	Guava Leaves	6gm	6gm	5.5gm	6gm
2.	Fennel Seeds	1gm	1gm	2gm	1.5gm
3.	Cumin Seeds	2.5gm	1gm	1.5gm	1gm
4.	Carom Seeds	0.5gm	2gm	1gm	1.5gm

F4 is an Ideal batch.

Evaluation Parameters of Herbal Digestive Churna:

Rheological evaluation:

1. **Angle of Repose:**

Angle of repose was determined using funnel method. The blend was poured through funnel can be raised vertically until a maximum cone height (h) was obtained. Radius of the up was measured and repose was calculated using the formula.

$\theta = \tan^{-1} h/r$

Whessre, θ is the angle of repose, h is height, r is radius.

2. **Bulk Density:**

Precisely weigh 5 grams of powdered color, then transfer it into a 100 milliliter measuring cylinder. Read the unclear apparent after carefully levelling the powder blend without compacting it worth.

Bulk density= Bulk mass/Bulk volume.

3. **Tapped Density:**

Precisely weigh 10g of powdered color, then transfer it into a 100ml measuring cylinder. Next, using mechanical tapped thickness, carefully tap the chamber holding the example by elevating the chamber and allowing it to fall under its own weight. analyzer at a nominal speed of 300 droplets per second.

Tapped Density=Mass/Tapped Volume.

4. **% Carr's index:**

The simplest way of measurement of free flow of powder is compressibility, an indication of the ease with which compressibility. compressibility a material can be induced to flow given by the compressibility index of the granules was determined by Carr's index (I), which is calculated by using the following formula.

(Tapped density- Bulk density)/ tapped density*100

5. **Housner's Ratio:**

Hausner predict the flow properties of powder by using interpartical friction. This is a simple index that can be determined on small qantities of powder.

It calculated by following formula-

Tapped density /Bulk density.[10,16,17]

Results and Discussion:

Four formulation of herbal digestive churna were prepared with concentation of four other herbal guava leaves, cumin seeds, fennel seeds, carom seeds were get evaporation method.

Table 3. Angle of Repose

Formulation	Angle of repose(degree)
F1	Θ=1.12
F2	Θ=1.11
F3	Θ=1.10
F4	Θ=1.10

Table 4. Bulk Density Determined

Formulation	Bulk Density(g/cm-3)
F1	2.17
F2	2.77
F3	2.04
F4	1.81

Table 5. Tapped density determined

Formulation	Tapped Density(g/cm-2)
F1	3.1
F2	3.3
F3	3.12
F4	3.1

Table 6. Car's Index Determined

Formulation	Car's Index(%)
F1	300
F2	0.16
F3	0.34
F4	0.41

Table 7. Hausner Ratio determined

Formulation	Hausner Ratio(w/vΘg/ml)
F1	1.42
F2	1.19
F3	1.52
F4	1.17

Conclusion:

The study explored the phytochemical composition, medicinal uses, and health benefits of guava leaves (Psidium guajava), fennel seeds (Foeniculum vulgare), cumin seeds (Cuminum cyminum), and carom seeds (Trachyspermum ammi). Each of these plant-based substances is rich in bioactive compounds such as flavonoids, terpenoids, phenolics, and essential oils.

Guava leaves exhibited strong antioxidant, antimicrobial, and antidiabetic properties due to high levels of quercetin and tannins.

Fennel seeds were noted for their digestive, anti-inflammatory, and antimicrobial actions, primarily due to anethole and fenchone.

Cumin seeds displayed antioxidant, anti-carcinogenic, and hypoglycemic activity linked to cuminaldehyde and other volatile oils.

Carom seeds showed potent antimicrobial, antispasmodic, and digestive effects, largely due to thymol and other phenolic compounds. In vitro and in vivo studies supported the traditional uses of these seeds and leaves in treating gastrointestinal disorders, infections, and metabolic diseases.

Guava leaves, fennel seeds, cumin seeds, and carom seeds each possess significant therapeutic potential, supported by both traditional medicine and scientific studies. Their bioactive compounds contribute to a wide

range of health benefits, particularly in gastrointestinal health, metabolic regulation, and antimicrobial resistance. Integrating these natural remedies into functional foods or pharmaceutical formulations could offer cost-effective, plant-based alternatives for disease prevention and management. Further clinical trials are necessary to standardize dosages and verify long-term efficacy and safety in humans.

References:

1. Gutiérrez, R. M. P., Mitchell, S., & Solis, R. V. (2008). Psidium guajava: A review of its traditional uses, phytochemistry and pharmacology. Journal of Ethnopharmacology, 117(1), 1–27.

2. Ojewole, J. A. O. (2006). Antiinflammatory and analgesic effects of Psidium guajava Linn. (Myrtaceae) leaf aqueous extract in rats and mice. Methods and Findings in Experimental and Clinical Pharmacology, 28(7), 441–446.

3. Chen, H. Y., & Yen, G. C. (2007). Antioxidant activity and free radical-scavenging capacity of extracts from guava (Psidium guajava L.) leaves. Food Chemistry, 101(2), 686–694.

4. Ojewole, J. A. O. (2005). Hypoglycemic and hypotensive effects of Psidium guajava Linn. (Myrtaceae) leaf aqueous extract. Methods and Findings in Experimental and Clinical Pharmacology, 27(10), 689–695.

5. Deguchi, Y., & Miyazaki, K. (2010). Anti-hyperglycemic and anti-hyperlipidemic effects of guava leaf extract. Nutrition & Metabolism, 7(1), 9.

6. Arima, H., & Danno, G. (2002). Isolation of antimicrobial compounds from guava (Psidium guajava L.) and their structural elucidation. Bioscience, Biotechnology, and Biochemistry, 66(8), 1727–1730.

7. Gutierrez, R. M. P., & Mitchell, S. (2011). Health effects of Psidium guajava L. leaves: An overview of the last decade. Pharmacognosy Reviews, 5(9), 85–92.

8. Lin, C. C., & Lin, J. M. (1997). Hypoglycemic and hypolipidemic effects of guava leaf extract. The American Journal of Chinese Medicine, 25(1), 1–10.

9. Jaiarj, P., Khoohaswan, P., Wongkrajang, Y., Peungvicha, P., Suriyawong, P., Saraya, M. L., & Ruangsomboon, O. (1999). Anticough and antimicrobial activities of Psidium guajava Linn. leaf extract. Journal of Ethnopharmacology, 67(2), 203–212.

10. Chen, K. C., Peng, C. C., Chiu, W. T., Cheng, Y. T., Huang, G. T., & Hsieh, C. L. (2010). Action mechanism and signal pathways of Psidium guajava L. aqueous extract in killing prostate cancer LNCaP cells. Nutrition and Cancer, 62(2), 260–270.

11. Rather, M. A., Dar, B. A., Sofi, S. N., Bhat, B. A., & Qurishi, M. A. (2016). Foeniculum vulgare: A comprehensive review of its traditional use, phytochemistry, pharmacology, and safety. Arabian Journal of Chemistry, 9, S1574–S1583.

12. Badgujar, S. B., Patel, V. V., & Bandivdekar, A. H. (2014). Foeniculum vulgare Mill: A review of its botany, phytochemistry, pharmacology, contemporary application, and toxicology. BioMed Research International, 2014. 13. Singh, G., Maurya, S., de Lampasona, M. P., & Catalan, C. (2006). Chemical constituents, antifungal and antioxidative potential of Foeniculum vulgare volatile oil and its acetone extract. Food Control, 17(9), 745–752.

14. Ozbek, H., Ugras, S., Dülger, H., Bayram, I., Tuncer, I., Ozturk, G., & Ozturk, A. (2003). Hepatoprotective effect of Foeniculum vulgare essential oil. Fitoterapia, 74(3), 317–319.

15. Choi, E. M., & Hwang, J. K. (2004). Antiinflammatory, analgesic and antioxidant activities of the fruit of Foeniculum vulgare. Fitoterapia, 75(6), 557–565.

16. Piccaglia, R., & Marotti, M. (2001). Characterization of some Italian types of wild fennel (Foeniculum vulgare Mill.). Journal of Agricultural and Food Chemistry, 49(1), 239–244.

17. Diao, W. R., Hu, Q. P., Feng, S. S., Li, W. Q., & Xu, J. G. (2014). Chemical composition and antibacterial activity of the essential oil from green huajiao (Zanthoxylum schinifolium) against selected foodborne pathogens. Journal of Agricultural and Food Chemistry, 62(14), 3429–3435.

18. Sowbhagya, H. B., & Sampathu, S. R. (2001). Spices as antimicrobial agents: A review. Journal of Food Science and Technology, 38(3), 95–104.

19. Kaur, G. J., & Arora, D. S. (2009). Antibacterial and phytochemical screening of Anethum graveolens, Foeniculum vulgare and Trachyspermum ammi. BMC Complementary and Alternative Medicine, 9(1), 30.

20. Singh, R., Shushni, M. A. M., & Belkheir, A. (2012). Antibacterial and antioxidant activities of Mentha piperita L. Arabian Journal of Chemistry, 5(4), 483–488.

21. Sowbhagya, H. B., & Bhattacharya, S. (2009). Cumin (Cuminum cyminum) and black cumin (Nigella sativa) seeds: Traditional uses, chemical constituents, and nutraceutical effects. Food Quality and Safety, 1(2), 1–14.

22. Dhandapani, S., Subramanian, V. R., Rajagopal, S., & Namasivayam, N. (2002). Hypolipidemic effect of Cuminum cyminum L. on alloxan-induced diabetic rats. Pharmacological Research, 46(3), 251–255.

23. Gagandeep, K., & Bansal, S. (2010). Antioxidant activity of cumin (Cuminum cyminum) seed extract. International Journal of Pharmacy and Pharmaceutical Sciences, 2(4), 80–82.

24. Srinivasan, K. (2005). Role of spices beyond food flavoring: Nutraceuticals with multiple health effects. Food Reviews International, 21(2), 167–188.

25. Kaur, G. J., & Arora, D. S. (2009). Antibacterial and phytochemical screening of Anethum graveolens, Foeniculum vulgare and Trachyspermum ammi. BMC Complementary and Alternative Medicine, 9(1), 30.

26. Sharma, S., & Agarwal, S. S. (1996). Antioxidant activity of cumin (Cuminum cyminum) essential oil. Journal of Essential Oil Research, 8(6), 657–664.

27. Nadkarni, K. M. (2000). Indian Materia Medica (Vol. 1). Mumbai: Popular Prakashan.

28. Goyal, R. K., & Singh, J. (2006). Cumin (Cuminum cyminum) as a potential antiulcerogenic agent. Indian Journal of Physiology and Pharmacology, 50(2), 142–144.

29. Sowbhagya, H. B., & Sampathu, S. R. (2001). Spices as antimicrobial agents: A review. Journal of Food Science and Technology, 38(3), 95–104.

30. Burt, S. (2004). Essential oils: Their antibacterial properties and potential applications in foods—A review. International Journal of Food Microbiology, 94(3), 223–253.

31. Bhattacharjee, R. & Das, A. (2020). Pharmacological potentials of Psidium guajava L. (Guava) leaf: A review. Journal of Pharmacognosy and Phytochemistry, 9(3), 1235–1240.

32. Bhat, S., Kaushal, P., Kaur, M., & Sharma, H. K. (2014). Coriander (Coriandrum sativum L.): Processing, nutritional and functional aspects. African Journal of Plant Science, 8(1), 25–33.

33. Rather, M. A., Dar, B. A., Sofi, S. N., Bhat, B. A., & Qurishi, M. A. (2016). Foeniculum vulgare: A comprehensive review of its traditional use, phytochemistry, pharmacology, and safety. Arabian Journal of Chemistry, 9, S1574–S1583.

34. Raut, S. D., & Tated, P. D. (2017). A review on medicinal uses of Ajwain (Trachyspermum ammi). World Journal of Pharmaceutical Research, 6(12), 1314–1325.

35. Srinivasan, K. (2014). Cumin (Cuminum cyminum) and black cumin (Nigella sativa) seeds: Traditional uses, chemical constituents, and nutraceutical effects. Food Quality and Safety, 1(2), 1–14.