

## A REVIEW ON AJWAIN PLANT AND ITS ALL PHARMACOLOGICAL ACTIVITIES

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DOI : <https://www.doi.org/10.56726/IRJMETS64820>

### ABSTRACT

Ajwain (*Trachyspermum ammi*), also known as carom seeds or omam, is a plant belonging to the Apiaceae (carrot) family and is commonly cultivated in regions like India, Egypt, Iraq, and Iran. The plant is valued not only as a culinary spice but also for its wide range of medicinal properties. Ajwain has been used for thousands of years in traditional medicine systems, including Ayurveda, Unani, and Traditional Persian Medicine (TPM). The medicinal uses of Ajwain are diverse and supported by both ancient practices and modern studies. The seeds, which contain essential oil rich in thymol, exhibit antifungal, antimicrobial, anti-inflammatory, anti-hypertensive, and digestive benefits. The primary applications of Ajwain include treating digestive disorders like indigestion, bloating, flatulence, and nausea. Additionally, it is used for respiratory issues such as cough, asthma, and bronchitis, as well as for its role in promoting appetite and easing abdominal pain. Ajwain also demonstrates significant pharmacological activity. It has been shown to possess anti-helminthic properties, meaning it can help expel intestinal worms. It also has hepatoprotective effects, protecting the liver from damage caused by toxins like paracetamol or carbon tetrachloride (CCl<sub>4</sub>). The seed oil is widely used in topical treatments, and its anti-inflammatory properties help with pain relief in conditions like arthritis. Furthermore, Ajwain's antioxidant properties play a role in detoxification and oxidative stress reduction, promoting overall health and wellness. In the context of Traditional Persian Medicine, Ajwain was used to treat neurological conditions like paralysis and tremors, as well as skin conditions like eczema and vitiligo. Its diuretic properties also make it beneficial for managing urinary stones and promoting kidney health.

**Keywords:** Carum Copticum, *Trachyspermum Ammi*, T. Ammi, Ajowan.

### I. INTRODUCTION

**Trachyspermum ammi** is commonly known as **ajwain** is indigenous variety of Egypt and is also cultivated in Iraq, Iran, Afghanistan, Pakistan, and India. In India, it is mainly cultivated in Madhyapardesh, Uttarparadesh, Bihar, Gujrat, Maharashtra, Rajsthan and West Bengal<sup>1</sup>.

**Scientific Name(s):** *Trachyspermum ammi* L. Sprague.

**Common Name(s):** Ajawa seeds, Ajowan caraway, Ajowan seed, Ajowanj, Ajwain, Bishop's weed, Carum, Omum, Yavani<sup>V</sup>. Ajwain is commercially available as a single entity or herbal blend in numerous dosage forms including capsules, liquids, powders, and cream<sup>2</sup>.

Clinical studies are limited. However, the medical literature documents numerous pharmacological activities for bishop's weed including anti-fungal, anti-microbial, hypolipidemic, antihypertensive, anti-lithiasis, abortifacient, anti-tussive, anthelmintic, and anti-filarial<sup>3</sup>.



Fig 1 – Ajwani Fruit

• **Synonyms-**

- a) Sanskrit – yamini , yaminiki, yavaniki.
- b) Assamese- jain.
- c) Bengali -Yamani, yauvan, yavan, yavani, javan, yavani, yoyana.
- d) English-Bishop's weed, carom seed.
- e) Gujarati- Ajma, Ajmo, yavan, javain.
- f) Hindi- Ajwain, jevain.
- g) Kannada- oma, yom, omu.
- h) Malayalam- oman, Ayanodakan.
- i) Marathi- onva.
- j) Oriya- Juani.
- k) Tamil -omam.
- l) Telgu- Vamu.<sup>30</sup>



**Fig No.2-** Ajwain plant

• **Side Effects of Ajwain**

When consumed in moderation, ajwain seeds do not produce any harmful side effects. However, in people suffering from conditions like diverticulitis (pain and inflammation in small, bulging pouches that can form in the lining of the digestive tract), ulcerative colitis (inflammatory bowel disease), and liver diseases, excess intake of ajwain might lead to some side effects. Ajwain seeds stimulate gastric secretions, which can worsen any existing peptic ulcers. It is essential to consult a doctor if this effect is observed. Overconsumption of ajwain can also lead to nausea, skin irritation, vomiting, allergy, and headache in some people.<sup>3</sup>

**II. TAXONOMICAL CLASSIFICATION**

**Table1no 1 -** Taxonomical Classification

Rank.	Scientific name and common name.
Kingdom	Plantae- plants
Subkingdom	Tracheobionta – vascular plant.
Super division	Spermatophyta - Seed plants.
Division	Magnoliophyta - Flowering plants.
Class	Magnoliopsida – Dicotyledons.
Subclass	Rosidae.
Order	Apiales.
Family	Apiaceae Lindl. - Carrot family.
Genus	Trachyspermum Link - Ajowan caraway.
Species	Trachyspermum ammi (L.) Sprague ex Turrill - Ajowan caraway.

It is a highly efficient medicinally important seed spice. Almost all the parts of Ajwain show different pharmacological actions.

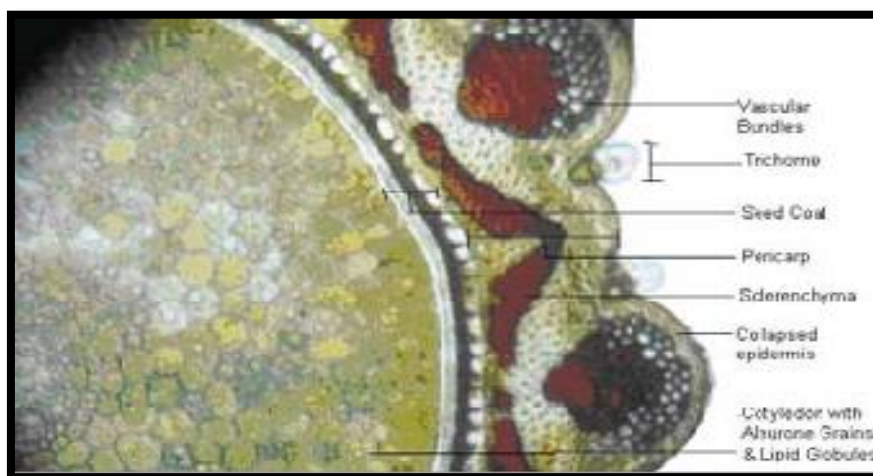
- **Roots:** Diuretic.
- **Seeds:** Aphrodisiac, Anthelmintic, Carminative, Laxative, Stomachic, Abdominal Tumours, Abdominal Pains and Piles. The seeds contain 2–4.4% brown colored oil known as Ajwain oil. The main component of this oil is thymol.
- **Seed Oil:** Gastro-intestinal ailments, lack of appetite, bronchial problems, fungicidal, antimicrobial, anti-aggregatory. Seed oil also used in toothpaste and perfumery.
- **Fruit:** Stimulant, antispasmodic and carminative properties and remedial agent for flatulence, atonic dyspepsia and diarrhea.<sup>5</sup>



**Fig no 3-** Trachyspermum ammi L

### III. MACROSCOPIC CHARACTERS

It is commonly grown in arid and semi-arid areas with high salt levels in the soil. Ajwain is an annual herb with many branches that grows between 60 and 90 cm tall. Its stem is striated, and its compound umbel inflorescence has 16 umbellet, each of which has up to 16 flowers. Its flowers are actinomorphic, bisexual, and white. The fruit is aromatic, ovoid, cordate, cremocarp with a persistent stylopodium; the leaves are pinnate, with a terminal and seven pairs of lateral leaflets; the fruit is composed of two grayish brown, ovoid, compressed mericarps, about 2 mm long and 1.7 mm wide, with five ridges and six vittae in each mericarp, which typically separate five primary ridges. The corolla has five petals, the stamens are five, and the stigma is knob-like.<sup>30</sup>



**Fig no 4 – T.S OF Ajwani Fruit**

#### • **Microscopic description –**

The fruit's transverse section displays two hexagonal structures connected by carpophores: the epicarps is made up of a single layer of tangentially elongated tabular cells, the mesocarp is made up of somewhat thick-

walled, rectangular to polygonal tangentially elongated cells with some vittae, carpophores and vascular bundles present as groups of thick-walled, radially elongated cells, integument, barrel-shaped tangentially elongated cells, and the endosperm is made up of thin-walled cells that are filled with embryos and oil globules, which are small, circular, and made up of polygonal thin-walled cells. Groups of endosperm cells and oil globules are visible under powder microscopy.<sup>30</sup>

#### IV. CHEMICAL CONSTITUTION/ PHYTOCHEMICAL STUDIES

Ajwain seed analysis has revealed it to contain fiber (11.9%), carbohydrates (38.6%), tannins, glycosides, moisture (8.9%), protein (15.4%), fat (18.1%), saponins, flavone and mineral matter (7.1%) containing calcium, phosphorous, iron and nicotinic acid. Ajwain fruits yield 2% to 4% brownish essential oil, with thymol as the major constituent (35% to 60%).<sup>6</sup>

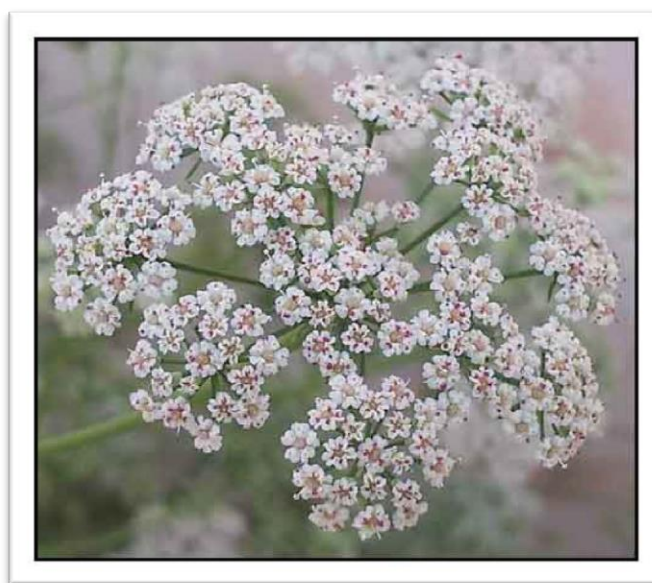


Fig 5 – Ajwani flower

Table 2 – chemical constituent

Chemicals constitution	Amount in %
Fiber	11.9%
Carbohydrates	38.6%
Glycosides , moisture.	8.9%
fat	18.1%
Mineral matter	7.1%
Calcium, phosphorous, iron, nicotinic	2%,4%
Thymol as the major constituent	35% and 60%.

#### V. APPLICATIONS OF AJWAIN IN MEDIEVAL AND TRADITIONAL PERSIAN MEDICINE

Ajwain has been commonly used in traditional medicine systems for a variety of medicinal and pharmacological aspects. In Traditional Persian Medicine (TPM), Ajwain was well known from thousands of years. Persian practitioners usually used seeds of Ajwain as the most useful part of the herb. According to its temperament, Ajwain is hot and dry in the third degree and also possesses some bitterness and acidity.

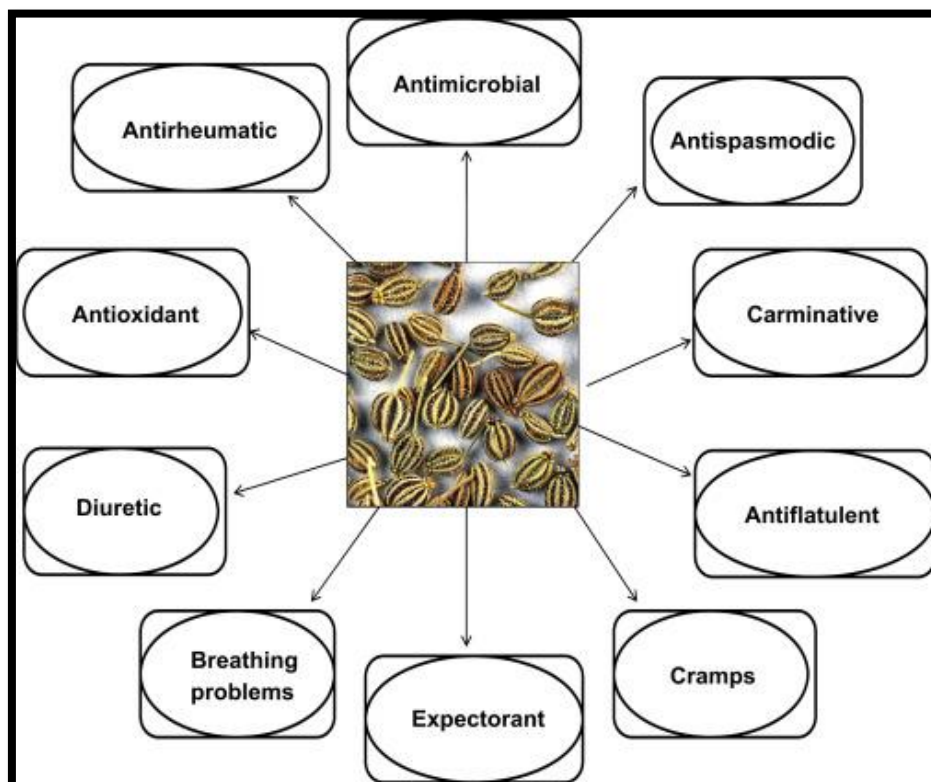




**Fig 6** – Ajwani powder

Oral application of seed was reported to be useful for paralysis, tremor and palsy as well as other neural disorders in the field of neurology. Persian practitioners also applied the eye and ear drop formulated from seeds of Ajwain in order to control the infected conditions and correct the auditory weakness. In the field of respiratory, Ajwain was said to be effective on cough, pleurisy and dysphonia. They were also said to be beneficial in stomach troubles and possess stimulant and carminative properties. Persian practitioners also considered the seeds as an aphrodisiac, galactagogue and diuretic agent. As a cosmetic agent, local administration of Ajwain as a paint results in yellowish complexion on the skin. It was also incorporated in medicine prepared for pityriasis and leukoderma and plastered with honey in cases of all types of ecchymosis. Ajwain was also introduced as a potent analgesic and anti-inflammatory agent. Therefore it was applied on the affected area solely or in combination with egg white or honey. Persian practitioners used Ajwain in chronic fevers and gripes. Hydrosol and oil extracted from the seeds of Ajwain was also used for medical purposes. Of those, management of paralysis, palsy, tremor and neurological disorders such as neuropathic pain as well as chronic pains are cited in Persian medical and pharmaceutical manuscripts. The Ajwain hydrosol combining with Borage and Cinnamon was highly recommended as a great enlivening medicine.<sup>7</sup>

### VI. PHARMACOLOGICAL ACTION



**Fig no 7-** Pharmacological Action Ajwain

**1. Anti-flatulent.**

Anti-flatulent from ancient times ajwain is used to relieve the retention of gas and flatulence when taken with warm water. It is an excellent natural home remedy to treat abdominal gas anorexia, nausea and vomiting.<sup>8</sup>

**2. Anti-helmintic Activity:**

The Anthelmintic activity of Ajwain shows its effect against specific helminths, e.g. The activity is shown by interference with the energy metabolism of parasites rough activation of ATPase activity and which results in loss of energy reserves.<sup>9</sup>

**3. Hepatoprotective Activity.**

Along with the potent antioxidant activity, the Ajwain methanolic extract revealed to exhibit in vivo hepatoprotective activity with eighty percent protection against a normally-lethal dose of paracetamol in mice. The extract also possessed preventive effects against CCl4-induced prolongation of pentobarbital sleeping time as well as equilibrating the level of hepatic enzymes, Alkaline Phosphatase (ALP) and Aminotransferases (AST and ALT) during liver damage.<sup>10</sup>

**Table no 3-** Hepatoprotective Activity.

Category	Helminthes
Humans	Ascaris lumbricoides
Sheep	Haemonchus contortus

**4. Antiulcer Activity.**

Trachyspermum ammi fruit have traditionally been used in India as medicinal plant for the treatment of indigestion and dyspepsia and many other gastric disorders. In the present study ethanolic extract of Trachyspermum ammi fruit was used for investigation of antiulcer activity by using pylorus ligation, as anti-secretory model and Indomethacin induced ulcer model, ethanol induced ulceration model, cold restraint stress induced ulcer model as cytoprotective model. Animals pretreated with ethanolic extract of Trachyspermum ammi fruit at the dose 100 mg/kg and 200 mg/kg showed significant decrease in ulcer index and percentage ulcer protection in all models. The results suggests that the extract at 100 mg/kg and 200 mg/kg showed significant protection ( $p < 0.001$ ) by reducing ulcerative lesions when compared with control group of animals. These findings indicate that Trachyspermum ammi fruit extract shows significant antiulcer activity.<sup>11</sup>

**5. Antitussive Activity.**

Antitussive effect of Ajwain has been mentioned in traditional medical manuscripts. In a study the an experiment was performed with macerated extracts of Ajwain seeds as well as with carvacrol, codine and saline resulting in decreased cough which shows its potent antitussive effect.<sup>12</sup> Various relative studies showed the inhibitory effect of both Ajwain extract and essential oil on Histamine (H1) receptors of isolated guinea-pig tracheal chains.<sup>13</sup>

**6. Analgesic and Antinociceptive Effects.**

In order to evaluate the analgesic and antinociceptive activity of Ajwain, an In vivo investigation was carried out using a Tail-flick Analgesiometer Device.<sup>14</sup> The study revealed that the ethanolic extract significantly increase in Tail-Flick Latency (TFL) within 2 hours post drug administration. An experimental trial study has also been carried out to compare the antinociceptive effect of the hydroalcoholic extract of Ajwain with morphine sulphate using formalin test. Findings revealed that Ajwain extract exhibited antinociceptive effect on both early and late phases.<sup>15</sup> Similar study has been done on the Ajwain total essential oil which was significantly effective on the late phase of formalin test and it may be due to the presence of thymol in essential oil.<sup>16</sup>

**7. Antibacterial and Antifungal Activities.**

To assay the antibacterial efficacy of Ajwain, acetone and aqueous extracts were tested against Enterococcus faecalis, Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Salmonella typhi, Salmonella typhimurium, Shigella flexneri, and Staphylococcus aureus using agar diffusion assay.<sup>17</sup> The study showed that acetone extract shows more activity compared to the aqueous extract. In another study, ethanolic extract of Ajwain possessed antibacterial activity against eight strains of Helicobacter pylori.<sup>18</sup> Also methanolic extract of Ajwain exhibited bactericidal activity against 11 species at 2mg/well in agar well-diffusion method. It was

measured by Diameter of Inhibition Zones (DIZ). DIZ was over 15mm against *Staphylococcus aureus* and *Staphylococcus epidermidis*; 10–14 mm against *Pseudomonas aeruginosa* and *Bacillus pumilus*; 7–9 mm against *Escherichia coli*, *Klebsiella pneumonia* as well as *Bordetella bronchiseptica*. On the other hand, no activity was reported against *Pseudomonas fluorescens* and *Micrococcus luteus*.<sup>19</sup>

#### 8. Diuretic and Anti-lithiasis Activity.

Ajwain was attributed to have diuretic and anti-lithiasis activity in ethno-pharmacological reports. Accordingly, a human study was performed and in which, seeds of Ajwain were decocted in milk and given orally to volunteers suffering from urinary stone for a nine days period. The results were reported satisfactory against pure ca-oxalate stone<sup>20</sup>

#### 9. Anti-hyperlipidemic Properties-

Another activity which has been proved for Ajwain is the anti-hyperlipidemic property. An in vivo study revealed that Ajwain seeds powder is extensively effective on lipid profile and can decrease total cholesterol, LDL-cholesterol, triglycerides and total lipids. Moreover, organic extract of seeds reduced atherogenic index and increased the level of HDL-cholesterol in albino rabbits.<sup>21</sup>

#### 10. Detoxification Activity -

Detoxification of aflatoxins by seed extract of Ajwain can support the related traditional reports. Hence in an experimental study, Ajwain seed extract exhibited the maximum degradation of aflatoxin G1.<sup>22</sup>

#### 11. Anti-oxidant Properties -

The antioxidant and ameliorative property of Ajwain extract has been evaluated on hexa-chlorocyclohexane induced oxidative stress and toxicity in an in vivo investigation. Accordingly, results revealed that the dietary Ajwain extract would reduce the toxicity resulted from hepatic free radical stress.<sup>23</sup>

#### 12. Anti-viral Effects -

For the evaluation of Ajwain antiviral activity, an in vitro assay was carried out on the methanolic extract of the herb which showed significant inhibitory effects on Hepatitis C Virus (HCV) protease.<sup>24</sup>

#### 13. Spermicidal Activity -

Spermicidal activities of Ajwain essential oil was determined via an in vitro study where it was revealed that the volatile oil possessed potent spermicidal action. Therefore, the oil may be considered as a natural contraceptive agent.<sup>25</sup>

#### 14. Hepatoprotective Effects

Along with the potent antioxidant activity, the Ajwain methanolic extract revealed to exhibit in vivo hepatoprotective activity with eighty percent protection against a normally-lethal dose of paracetamol in mice. The extract also possessed preventive effects against CCl<sub>4</sub>-induced prolongation of pentobarbital sleeping time as well as equilibrating the level of hepatic enzymes, Alkaline Phosphatase (ALP) and Aminotransferases (AST and ALT) during liver damage.<sup>26</sup>

#### 15. Antihypertensive and Antispasmodic

Activity Ajwain was evaluated for the potentiality of antihypertensive and antispasmodic activity. In the related investigation, the aqueous-methanolic extract of the seeds caused a dose dependent decrease in arterial blood pressure in anaesthetized animal models. Furthermore, inhibitory effect on the K<sup>+</sup>-induced contractions was seen in isolated rabbit aorta and jejunum preparations during the application of Ajwain extract. These findings prove the potential antihypertensive and antispasmodic activity of Ajwain.<sup>27</sup>

#### 16. Digestive Stimulant.

Activity Traditional practitioners recommended the herb as a digestive stimulant medicine. It is now proved that Ajwain can increase the secretion of gastric acid, bile acids and activity of digestive enzymes. It may also reduce the food transient time. As the enzyme modulatory activity, Ajwain reinforced the pancreatic lipase and amylase effectiveness, which may support the digestive stimulant activity.<sup>28</sup>

### 17. Estrogenic Activity

The total phytoestrogen content of dry Ajwain seed was determined as 473 ppm. In this regard, the herb is the second highest in the list of plants tested for total phytoestrogen content. It should be noted that the herb has been traditionally used as a galactagogue.<sup>28</sup>

### 18. Toxicity and Teratogenicity

It was reported that Ajwain showed teratogenicity in rat fetuses. Therefore it may be harmful to be intake during pregnancy.

## VII. ADVANTEGEG OF AJWAIN FORMULATION

- 1. Digestive Health:** Ajwain is known for its carminative properties, which help in relieving indigestion, bloating, and gas. It stimulates the secretion of digestive enzymes, aiding in better digestion<sup>1</sup>.
- 2. Respiratory Relief:** Ajwain can help alleviate respiratory issues like asthma and bronchitis due to its bronchodilatory properties.
- 3. Anti-inflammatory:** It has anti-inflammatory properties that can help reduce inflammation in the body.
- 4. Antimicrobial:** Ajwain seeds have antimicrobial properties, which can help fight infections.
- 5. Pain Relief:** It can act as an analgesic, providing relief from pain.
- 6. Heart Health:** Ajwain may help improve cholesterol levels and reduce the risk of heart disease.
- 7. Rich in Nutrients:** Ajwain is a good source of vitamins and minerals, including calcium, iron, and potassium<sup>31</sup>

## VIII. DISADVANTAGES OF AJWAIN FORMULATION

- 1. Gastrointestinal Issues:** Excessive consumption of ajwain can lead to stomach irritation and discomfort.
- 2. Allergic Reactions:** Some individuals may experience allergic reactions, which can include symptoms like itching, hives, or swelling.
- 3. Liver Toxicity:** Long-term use or high doses of ajwain can potentially lead to liver toxicity.
- 4. Pregnancy Concerns:** Ajwain is known to stimulate uterine contractions, so it should be used with caution during pregnancy.
- 5. Blood Clotting:** Ajwain might affect blood clotting, so it should be used with caution if you are on blood-thinning medications or have a bleeding disorder.
- 6. Drug Interactions:** Ajwain can interact with certain medications, such as those for diabetes and blood pressure, potentially leading to adverse effects.<sup>31</sup>

## IX. CONCLUSION

Ajwain (*Trachyspermum ammi*) is a versatile medicinal plant with a rich history in traditional medicine systems like Ayurveda, Unani, and Traditional Persian Medicine. Its seeds, rich in thymol, offer a wide array of therapeutic benefits, including digestive support, antimicrobial, anti-inflammatory, hepatoprotective, and anti-helminthic effects. Modern research validates many of its traditional uses, demonstrating its efficacy in treating digestive disorders, respiratory issues, and inflammation. Additionally, Ajwain's antioxidant, diuretic, and analgesic properties further contribute to its medicinal value. Despite limited clinical studies, the plant holds great promise as a natural remedy with diverse applications for overall health and wellness.

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