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# The Study of Antimicrobial Potential of Different Herbs

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**Abstract:** ***Due to their therapeutic properties, medicinal plants and spices have been utilised as herbal medicine since ancient times. They are important sources of naturally occurring antimicrobial chemicals that are used to treat infectious diseases brought on by bacteria and other pathogens. Plant extracts, essential oils, and a variety of secondary chemicals have antibacterial, antiviral, antifungal, and antioxidant properties with few to no harmful consequences; these properties are crucial for the treatment of several illnesses. The substances extracted from the therapeutic spice plants exhibit antibacterial action against some bacterial strains that can impact food quality and shelf life. Anti-inflammatory, tonic, expectorant, diuretic, astringent, digestive, carminative, antibacterial, and stimulant effects are only a few of the therapeutic qualities of these plants. The hunt for natural antimicrobial agents derived from medicinal herbs and spices has accelerated due to the increasing resistance of pathogenic microbes to conventional antibiotics. The antibacterial properties of three spices that are frequently used in traditional medicine and cooking Ajwain (Trachyspermumammi), Cumin (Cuminum cyminum), and Hing (Ferula asafoetida) are examined in this study. Using the agar well diffusion method, ethanolic and aqueous extracts of each spice were made and evaluated against specific bacterial and fungus strains, such as Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, and Candida albicans. All three extracts demonstrated detectable antibacterial action, according to the data, with Ajwain exhibiting the largest inhibitory zones, especially against Gram-positive bacteria. Hing revealed significant antifungal qualities, while cumin showed mild antibacterial effects.***

**Keywords:** Medicinal plant, Antibacterial, Antifungal, Herbal Medicine, Asafoetida extract

## 1. Introduction

The development of bacterial resistance to current pharmaceuticals was suited for the particular antibacterial property. Osteomyelitis, food poisoning, toxic shock syndrome, and a number of infections are caused by gram-positive bacteria such Staphylococcus species. Gram-negative bacteria, such as Escherichia sp., can cause septicaemia, bacterial infections, pneumonia, and lower urinary tract infections. (1). God has given plants the innate ability to synthesise therapeutic substances. Some plants have been utilised as herbal medicine since ancient times due to their therapeutic properties (2). As a result, these therapeutic plants are important sources of resistance to currently accessible pharmaceuticals (3). Many efforts have been made in recent years to identify sophisticated antibacterial chemicals from various natural resources (4).

The continuous settings in which the infections develop therapeutic resistance make it more important to determine the antibacterial activity of the various medicinal plants. Antimicrobial resistance must be reduced by using antibiotics to prevent and cure various diseases brought on by bacterial, viral, and fungal pathogens. Evaluating the elements that contributed to the development of medications with stronger antibacterial qualities is therefore the most crucial phase (5).

Among the most prevalent gastrointestinal issues impacting people globally are digestive disorders include indigestion, flatulence, and discomfort in the abdomen. Many herbal therapies have been used to treat such diseases in traditional medical systems like Ayurveda, Siddha, and Unani. These include Cumin (Jeera), Hing (Asafoetida), and Ajwain (Carom seeds). Among these, the powerful carminative, digestive, and antispasmodic properties of Hing (Asafoetida), Ajwain (Carom seeds), and Cumin (Jeera) are well known. Many polyherbal digestive (6) products, such as tonics and syrups, are based on the combination of these three herbs.

### 1) Application of Ajwain in Medieval and Traditional Persian:

Ajwain's uses in traditional Persian medicine and the Middle Ages Traditional medical systems have frequently employed ajwain for a number of pharmacological and therapeutic purposes (7). For thousands of years, Ajwain was widely recognised in Traditional Persian Medicine S(TPM). The most beneficial element of the herb, according to Persian practitioners, is the seeds of ajwain (8). Ajwain's temperament indicates that it is hot and dry in the third degree, with some acridity and bitterness (9). Palsy, tremor, paralysis, and other neurological conditions have all been shown to benefit by oral seed application.

### 2) History of use of medicinal plants and spices:

According to the World Health Organisation (WHO), 80% of people worldwide rely on traditional medicines, and medicinal plants constitute the best source of pharmaceuticals (10). In Asia, people have been using plants as medicine for a very long time. Herbal therapy uses a variety of special substances to treat chronic and infectious diseases (11). Records that indicate the use of therapeutic

plants date back around 5000 years, according to ancient records (12).

### 3) Selective of drugs

**a) Hing:**

Asafoetida is a perennial herbaceous, monoecious member of the Apiaceae family (umbelliferace). The sulphur component in the plant gives it a foul odour. Asafoetida The dried latex or oleo gum resins from the rhizomes or roots of this perennial herb are known as Asafoetida or Hing. This plant can grow up to two meters in height (13). The plant has glossy, oblong, pinnate leaves that can grow up to 45 cm long, short, robust and hollow.Succulent, sturdy, smooth, herbaceous, 10 cm thick, with several ducts. (14)

The rhizome and root of Ferula asafoetida, a member of the oils, resin, and gum family, are used to make hing, an oleo-gum-resin that contains bioactive substances like ferulic acid, asaresinotannol, and sulfur-containing terpenes that have potent antispasmodic and antiflatulent properties (Ravindran et al., 2016). It has historically been used to treat digestive issues, colic, and gas. (15).

**Hing (Asafoetida)**

**b) Cumin:**

It belongs to the family Apiaceae. It is frequently referred to as jeera. India is where it is most commonly used as a spice. It possesses diuretic, emnanogogic, carminative, stimulating, and antispasmodic qualities (16). One of its main components is cuminal.

**Antimicrobial activity of cumin:**

Numerous microbiological species, including E. coli, P. aeruginosa, S. aureus, and Bacillus pumilus, were tested for the antibacterial activity of the cumin extract. It was discovered that cumin extract worked well against every tested strain of bacteria (17).

**Cumin**

**c) Ajwain:**

Ajwain or thymol seeds are popular names for Trachyspermumammi. It is used as a spice and is a member of the Apiaceae family. The plant's seeds are frequently used to make breads, biscuits, and other foods. Antioxidants, vitamins, minerals, and fibre are all included in ajwain seeds. The main ingredient in ajwain is the chemical structures of thymol, γ-terpinene, and pinene. It is used to treat skin infections and clean wounds (18).

**Antimicrobial activity of Ajwain:**

The inhibitory effect of ajwain essential oil was observed against the gram-positive bacteria such as S. aureus and gram-negative bacteria such as E. coli, Klebsiella pneumoniae. The Minimum inhibitory concentration (MIC) values were determined. The results showed the essential oil of ajwain has antimicrobial properties. For the bacterium mg/mL, for E. coli MIC 2.5 mg/mL and for S. aureus MIC of 1.25 mg/mL respectively (19).

Ajwain (Trachyspermumammi), also a member of the Apiaceae family, contains essential oils rich in thymol, p-cymene, and Y-terpinene, which are responsible for its antimicrobial, carminative, and stimulant properties. It is known to enhance the secretion of digestive enzymes and improve gastrointestinal motility (Ravindra et al., 2013).(20).

**Ajwain**

**Antiplatelet Activity:**
Antiplatelet activity has been done on the dried ethereal extract of Ajwain. Therefore, in an in vitro study with human blood samples, Ajwain seeds inhibited the platelet aggregation induced by arachidonic acid, collagen and epinephrine (21).

**Effects Anti-inflammatory:**
Ajwain was assessed for displaying anti-inflammatory as a result, both complete alcoholic and total aqueous extracts have strong anti-inflammatory effects in vivo (22).

**Antitussive and Bronchodilatory Effects:**
Ajwain was assessed for displaying anti-inflammatory as a result, both complete alcoholic and total aqueous extracts have strong anti-inflammatory effects in vivo (22).

**Detoxification Activity:**
The associated traditional reports can be supported by the detoxification of aflatoxins by Ajwain seed extract. Ajwain seed extract therefore showed the greatest aflatoxin G1 degradation an experimental study (24).

**Antioxidant Properties:**
Inan in vivo study, hexachlorocyclohexane-induced oxidative stress and toxicity were used to assess the antioxidant and ameliorative properties of ajwain extract. The dietary Ajwain extract would therefore lessen the toxicity brought on by hepatic free radical stress, according to the data (25).

**Antiviral Effects:**
An in vitro test was conducted to assess the antiviral activity of ajwain. out on the herb's methanolic extract, which demonstrated notable Hepatitis C virus (HCV) protease inhibitory effects (26)

**4) Bacterial of Drug: P.aeruginosa:**

- **Location:** Commonly found in soil, water, plants, and moist hospital environments (sinks, catheters, etc.). (31)
- **Structure:** Has a cell wall, outer membrane, single polar flagellum, and pili; produces pigments like pyocyanin (blue-green). (32)
- **Shape:** Rod-shaped (bacillus). (33)
- **Growth:** Aerobic (can also grow anaerobically using nitrate); grows best at 37 °C; forms biofilms.
- **Gram information:** Gram-negative bacterium. (34).

**Symptoms:**

- **Lungs (pneumonia):** Cough with greenish sputum, fever, shortness of breath.
- **Urinary tract:** Burning urination, frequent urination, fever.
- **Ear ("swimmer's ear"):** Ear pain, discharge with sweet smell, itching
- **Eye**: Redness, pain, blurred vision, discharge.
- **Blood (sepsis):** Fever, chills, low blood pressure, confusion. (35)

**a) Ajwain:**
Trachyspermumammi, or ajwain Thymol, carvacrol, and p-cymene are active substances. Impact on P. aeruginosa There has moderate to strong antibacterial activity, according to numerous investigations. Bacterial cell membranes are disrupted by thymol and carvacrol, which increases permeability and allows cellular contents to flow out. Because P. aeruginosa depends heavily on biofilm for resistance, ajwain extracts—particularly ethanolic or methanolic ones—can prevent the production of biofilms. Depending on concentration, reported zones of inhibition (agar diffusion) usually fall between 10 and 20 mm (26)

**b) Cumin:**
Cumin (Cuminum cyminum) Cuminaldehyde, β-pinene, and γ-terpinene are active chemicals. Impact on P. aeruginosa has a mild antibacterial action; it is not as strong as ajwain. Bacterial energy metabolism and membrane function are disrupted by cuminaldehyde. may result in partial suppression of quorum sensing (cell-cell signalling used in pathogenicity) and modest growth inhibition. There have been reports of some synergy when paired with antibiotics (gentamicin, for example). (27)

**c) Hing:**
Ferula asafoetida, or Hing (Asafoetida) Umbelliferone, ferulic acid, and many sulfur compounds are active substances. Impact on P. aeruginosa demonstrates mild to moderate antimicrobial activity. Bacterial thiol-based enzyme systems can be disrupted by sulfur- containing substances. demonstrates some capacity to inhibit the formation of biofilms by reducing the creation of slime (EPS). The extraction solvent (ethanolic > aqueous) has a significant impact on effectiveness. (28)

- Total comparison Plant extract's primary active ingredient or compounds' impact on P. aeruginosa potency (approximate) Strong antibacterial and anti-biofilm properties of Ajwain Thymol and Carvacrol Moderate antibacterial properties of cumin cuminaldehyde Sulfur compounds and ferulic acid have weak-to-moderate antibacterial properties. (29)
- Action mechanisms First. Ion and protein leakage due to breakage of the cell membrane. Two. Biofilm and virulence factors are decreased by quorum sensing suppression. Third. Bacterial metabolism is disrupted by enzyme inhibition. Four. When used with traditional antibiotics, synergistic effects are amplified. (30).

## 2. Conclusion

According to the current study, hing (asafoetida), ajwain (Trachyspermumammi), and cumin (Cuminum cyminum) show encouraging antibacterial efficacy against a range of harmful microbes. Their capacity to prevent the growth of bacteria and fungi is facilitated by the presence of bioactive substances including ferulic acid, thymol, and cuminaldehyde. These results imply that these widely used culinary herbs have substantial medicinal potential as natural antibacterial agents in addition to their value as flavouring agents. Their use in the food preservation and pharmaceutical industries could be improved by more investigation and standardisation.

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