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ASAFOETIDA: A REVIEW ON BIOLOGICAL AND MEDICINAL PROPERTIES

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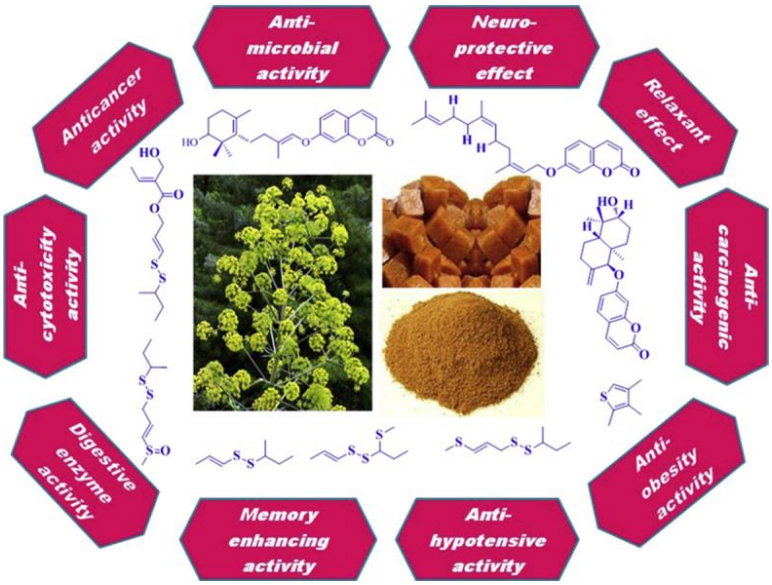
Abstract: Ferula asafoetida Linn. is a main source of asafoetida. It has pungent, persistent, sulfurous odor, and oleo-gum resin, which has nutritional and therapeutic value, is Ferula asafoetida Linn. For millennia, people have used asafoetida as a spice and traditional medicine. Numerous intriguing properties have been revealed by recent research, including antispasmodic, hypotensive, hepatoprotective, antimicrobial, anticarcinogenic, anticancer, anticytotoxicity, antiobesity, anthelmintic, digestive enzyme, antioxidant, and antagonistic effects. Asafoetida's phytochemistry as well as several pharmacological and clinical investigations are comprehensively covered in this article.

Keywords: Ferula asafoetida Linn. Oleo-gum-resin, Sulfur compounds, Sesquiterpenes, Biological activities.



INTRODUCTION

Spices have been used as culinary garnishes for thousands of years to improve the flavor and texture of meals. They may enhance the flavor, color, and pungency of an otherwise boring food preparation to create a visually appealing and enticing dish. In addition to being used alone, spices may also be combined to create blends known as curry powders that are used in a variety of recipes and tastes.. There are various proven medical benefits of spices. In recent decades, a variety of physiological benefits of spices in food have been empirically shown for health. In many regions of the world, asafoetida is used as a traditional medicine to treat a variety of ailments as well as a culinary flavoring. Ferula asafoetida, often known as asafoetida, is an oleo-gum-resin that is extracted from the stems of Ferula plants, which are members of the Umbelliferae family. Sixty of Ferula's more than 170 species are extensively spread across Central Asia, especially in West Afghanistan, Iraq, Turkey, Eastern Iran, Europe, and North Africa.One of the significant species of Ferula, F. asafoetida, is mostly endemic to Afghanistan and Iran. It reaches a height of around 2 meters and comes in two varieties: bitter and sweet.Six In India, asafoetida is referred to as Hing or Hingu..

Asafoetida is extracted from Ferula plants, which have massive taproots or carrot-shaped roots that are about 15 cm in diameter at the crown when the plants are 4–5 years old. Before the plants flower, the upper part of the living rhizome root is laid bare and the stem is cut off close to the crown. The exposed surface is covered in a dome-shaped structure made of twigs and earth. A milky juice exudes from the cut surface. The exudates are scraped off and a fresh slice of the root is cut when more latex emerges; occasionally the resin is removed along with the slice. This process is repeated until the exudation stops. Other names in different languages.

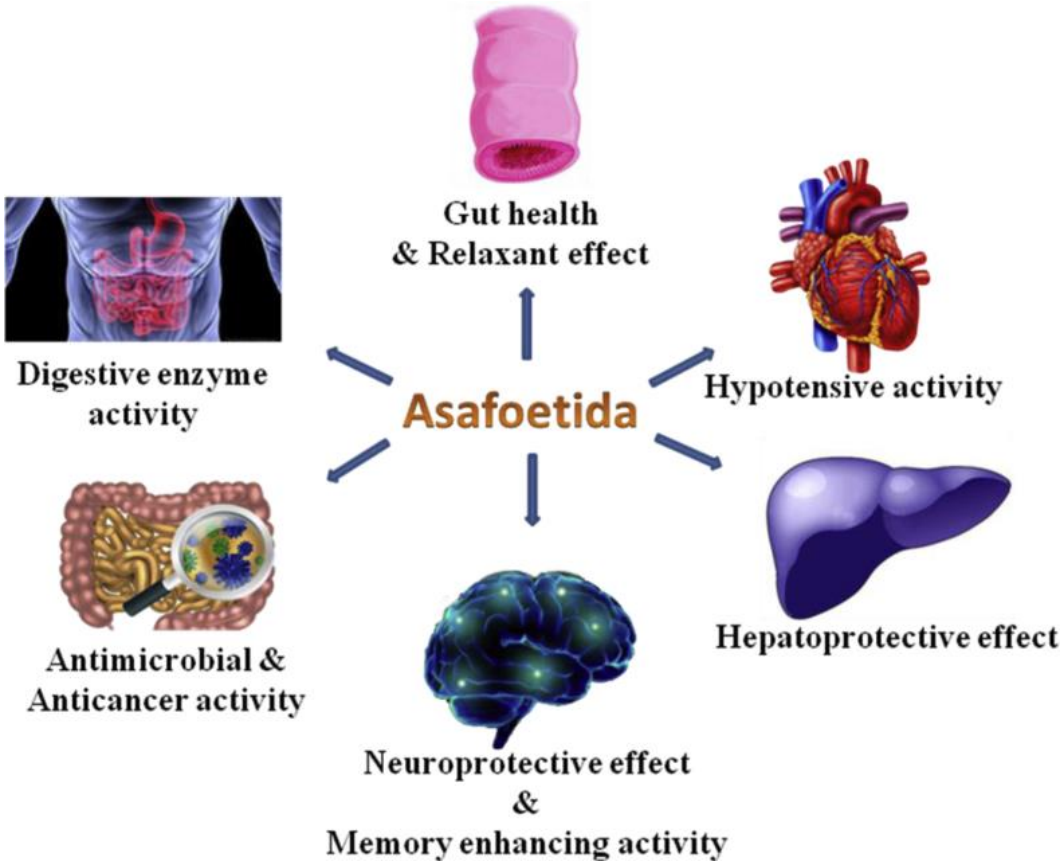
It is a common component in Indian cooking these days, most likely due to the fact that its aroma is similar to that of meat and garlic, two veggies that are just starting to bloom. Numerous illnesses, including whooping cough, asthma, ulcers, epilepsy, stomachaches, flatulence, bronchitis, intestinal parasites, antispasmodics, poor digestion, and influenza, have historically been treated with asafoetida and so on Asafoetida is a useful treatment for a number of gastrointestinal disorders. Asafoetida's digestive stimulant properties, which increase salivary amylase activity and salivary production, are the most often seen positive physiological impact. By increasing bile flow, bile acid production, and the activity of the pancreatic and small intestine's digestive enzymes, it plays a significant part in the digestion of dietary lipids. It is also used to treat low stomach acid, gas, stomach pressure, and loose stools. It is specifically regarded as a female-specific illness. It is used to treat a variety of issues, including leucorrhea, difficult and heavy menstruation, sterility, unusual discomfort, and undesired miscarriage.

CHEMICAL CONSTITUENTS

Generally speaking, asafoetida is composed of around 68% carbs, 16% moisture, 4% protein, 1% fat, 7% minerals, and 4% fiber. It is composed of three major fractions: gum (25%) and essential oil (10–17%), together with resin (40–64%). Ferulic acid and its esters, coumarins, sesquiterpene coumarins, and other terpenoids are all present in the resin fraction. Glucuronic acid, glucose, galactose, 1-arabinose, rhamnose, polysaccharides, and glycoproteins are all present in the gum, whereas sulfur-containing substances, monoterpenes, and other volatile terpenoids are found in the volatile fraction. The sulfur compounds found in F. asafoetida resin exhibit a range of biological functions and may have therapeutic applications. 2-butyl 1-propenyl disulfide, 1-(methyl thio) propyl 1-propenyl disulfide, and 2-butyl 3-(methyl thio)-2-propenyl disulfide are the three main sulfur components that have been found. The primary components of F. asafoetida have detailed characterizations. The chemical structures of sulfur-containing compounds and significant sesquiterpene coumarins found in F. asafoetida.

PHARMACOLOGICAL AND CLINICAL STUDIES OF ASAFOETIDA

Asafoetida has been the subject of several scientific studies that have examined its pharmacological and physiological effects as well as critical analyses of these effects. Diagram showing the several biological functions of Asafoetida.



4.1. Relaxant effect

It was shown that different formulations of F. asafoetida and its ingredients had relaxing effects on distinct kinds of smooth muscles. Three cumulative concentrations of the aqueous extract (2, 5 and 10 mg/mL), theophylline (0.25, 0.50 and 0.75 mM), and saline were tested on non-incubated guinea pig tracheal smooth muscle precontracted by 10 μM methacholine in group 1, pre-incubated tissues by propranolol and chlorpheniramine, contracted by methacholine in group 2, and pre-incubated tissues by propranolol contracted by methacholine in group 3. This allowed for an investigation of the relaxant effect of asafoetida on guinea pig tracheal smooth muscle and its likely mechanisms. When compared to saline, all theophylline concentrations in group 1 and all extract concentrations in the remaining three groups had significant relaxing effects.

4.2. Neuroprotective effect

According to conventional uses and some new research, F. asafoetida may have certain influence on how the nervous system functions, especially in terms of neuroprotective and nerve-stimulating actions. Tayeboon et al. looked into the effects of F. asafoetida extract administration on glutamate-induced cell injury in primary culture of rat cerebellar granule neurons. After seven days in rat brains and eight days in culture, respectively, cerebellums and cerebellar granule neurons were extracted. F. asafoetida extract was applied to cerebellar granule neuron cells at a concentration of 100 μg/mL prior to, during, and subsequent to their exposure to 30 μM glutamate. The reduction in cellular viability caused by glutamate and the

attenuation of glutamate-induced apoptotic/necrotic cell death demonstrate the neuroprotective effects of F. asafoetida extracts against glutamate-induced neurotoxicity.

4.3. Memory enhancing activity

For most persons with Alzheimer's disease worldwide, memory loss is the initial symptom to appear. The impact of an F. asafoetida extract on rat learning and memory was studied by Vijayalakshmi et al. Following the oral administration of two dosages (200 and 400 mg/kg) of F. asafoetida aqueous extract, learning and memory were assessed using the elevated plus maze and passive avoidance paradigm, with rivastigmine serving as a positive control. In the raised plus maze paradigm, the extract significantly improved the memory score and dose-dependently improved the transfer latency. Significant increases in antioxidant levels and dose-dependent inhibition of brain cholinesterase were also observed.

4.4. Digestive enzyme activity

Spices are often thought to improve the flow of saliva, secrete gastric juice, and aid in digestion. The spices' ability to stimulate digestion most likely results from an increase in enzyme activity involved in digesting. A few popular spices or their active ingredients were investigated to see whether they would have an impact on the pancreatic digestive enzymes in an experimental rat. Curcumin (0.5 mg), capsaicin (15 mg), piperine (20 mg), ginger (50 mg), cumin (1.25 mg), fenugreek (2 mg), mustard (250 mg), and asafoetida (250 mg) were fed to animal groups for eight weeks.

4.5. Antispasmodic and hypotensive activity

In 2004, F. asafoetida gum extract was shown by Fatehi et al., to be useful in lowering blood pressure in normotensive rats under anesthesia. The study examined the impact of F. asafoetida gum extract on the mean arterial blood pressure of rats as well as the contractile responses of the isolated guinea-pig ileum activated by histamine, acetylcholine, and KCl. When compared to the control, the isolated guinea-pig ileum's average spontaneous contraction amplitude was smaller. The precontracted ileum relaxed in a dose-dependent manner when exposed to F. asafoetida gum extract via acetylcholine. In rats under anesthesia, F. asafoetida gum extracts dramatically lowered the mean arterial blood pressure. We may conclude that the relaxant chemicals in the gum extract of F. asafoetida inhibit a range of muscarinic adrenergic and histaminic receptor actions.

4.6. Hepatoprotective effect

A number of extracts from Momordica charantia Linn., Nardostachys jatamansi, and F. asafoetida were investigated by Dandagi et al. in 2008 for their potential to protect the liver against experimental hepatotoxicity. These extracts, which were prepared as polyherbal suspensions, demonstrated notable efficacy when tested using LIV-52 as the benchmark for physicochemical and hepatoprotective effects. Three formulations were prepared; Formulation 3 (containing alkaline phosphatase, glutamate pyruvate transaminase, glutamate oxaloacetate transaminase, and aqueous extracts of F. asafoetida, petroleum ether, and ethanol extracts of M. charantia Linn. and N. jatamansi) has demonstrated a significant hepatoprotective effect by lowering elevated serum enzyme levels of these enzymes. Additionally, experimental studies indicated that Formulation 3 administration improves recovery from hepatotoxicity induced carbontetra chloride.

4.7. Antimicrobial activity

Spices' antimicrobial action is dependent on a number of variables, including the species class, the composition, concentration, and frequency of the spices, the substrate's composition, processing conditions, and storage. A spice and herbal remedy called asafoetida is used to cure a variety of germs and fungus. The antibacterial activity of asafoetida crude extracts was assessed against a range of bacterial and fungal

species. Using the agar disc diffusion method, it was found that asafoetida extracts, both alcoholic and aqueous, significantly inhibited the growth of Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Aspergillus niger.

4.9. Anticancer activity

When 1,2-dimethylhydrazine was used to induce colon cancer in rats, Panwar et al. (2015) examined the chemopreventive potential of various doses of F. asafoetida oleo-gum-resin by assessing tumor size, multiplicity, and incidence as well as serum total sialic acid levels and the histoarchitecture of the colons of the rats given different treatments. The results of the investigation showed that supplementing with asafoetida reduces the harmful effects that 1,2-dimethylhydrazine causes in rats. The biochemical parameters evaluated were all consistently affected by the least dose of asafoetida (10 mg/100 g), which had a more notable impact. This suggests that asafoetida might be a potential chemopreventive drug in the fight against colon carcinogenesis.

4.10. Anti-quorum sensing activity

The anti-quorum sensing ability of F. asafoetida against P. aeruginosa was evaluated. The essential oil of F. asafoetida completely stopped Chromobacterium violaceum from producing violacein and showed anti-quorum action at a concentration of 25 µg/mL. The generation of biofilm, elastase, pyocyanin, and pyoyerdine was reduced in the F. asafoetida oil treatments. Asafoetida was identified as a new anti-quorum sensing and virulence inhibitor by expression analysis of quorum sensing dependent genes.

4.11. Antihyperglycemic effect

In streptozotocin-induced diabetic rats, Akhlaghi et al. assessed the asafoetida extract's hypoglycemic potential. In streptozotocin-diabetic rats, asafoetida extract administered at a concentration of 50 mg/kg for four weeks demonstrated hypoglycemic action during the second and fourth weeks of therapy. It's possible that the extract's tannins and phenolic acid contribute to the lowered blood glucose levels in streptozotocin-induced diabetic animals.

4.12. Farnesyltransferase inhibition, protein and metabolic activity

The protein farnesyltransferase (FTase) is required for the farnesylation of the activated ras oncogene product before it may begin to exhibit carcinogenic activity. the identification of galbanic acid, a sesquiterpene produced from coumarins, and the four structurally related sesquiterpenes karatayicinol, umbelliprenin, farnesiferol B, and farnesiferol C from F. asafoetida extract as the active principle for FTase inhibitory function.

4.13. Anti-cytotoxicity activity, anti-obesity and fat lowering effect

Bagheri et al. assessed the cytotoxicity and anticonvulsant properties of methanol extracts from many Ferula species, especially F. asafoetida. The brine shrimp (Artemia salina) was used as a model test system to assess general cytotoxicity, and it offered an appropriate internal pre-screening technique. Both the oleo-gum resin of F. asafoetida and the methanol extracts of Ferula species demonstrated cytotoxicity, with LC50 values ranging from 6 to 321 µg/mL and a dose-dependent pattern. The impact of F. asafoetida on weight growth, fat accumulation, hepatic steatosis, and leptin levels in rats with type 2 diabetes was studied by Azizian et al. F. asafoetida oleo-gum resin was administered at dosages of 25 or 50 mg/kg to two treatment groups. When F. asafoetida was administered to rats instead of those who were not, the rats' body weight, aberrant fat, and epididymal adipocyte size all significantly decreased. In treated rats, serum leptin levels were much lower. The findings demonstrated the strong anti-obesity, fat-lowering, and liver-steatosis-prevention properties of F. asafoetida gum. F. asafoetida gum is a promising therapy option for obesity and hepatosteatosis brought on by diabetes.

4.14. Anxiolytic effect and anthelmintic activity

In 2012, Algasoumi used the hole-board test, elevated plus maze, hot plate, and motor activity meter to investigate the sedative, analgesic, and anxiolytic effects of asafoetida in rats. As a reference anxiolytic, diazepam was used. The findings indicate that asafoetida has analgesic and anxiolytic effects that are dose-dependent, with large dosages producing a calming sedative effect. When compared to diazepam, asafoetida seems to be a more effective therapy option for anxiety disorders. Asafoetida at modest dosages may provide a therapeutic substitute for the anxiolytic medications now in use.

4.15. Spermatic, testicular histopathology and antagonistic effect

The efficacy of asafoetida on testis tissue, blood testosterone levels, and spermatic parameters was assessed by Bagheri et al in 2015. Sperm viability and quantity were greatly enhanced by asafoetida. A histological analysis revealed that when the dosage was raised, so did the quantities of Leydig cells and the spermatogenesis process. When comparing the experimental groups to the control group, it was discovered that the Johnsen score was higher. Even while asafoetida has been demonstrated to have favorable effects on spermatic parameters, it has also been shown to have histopathological effects on the testis, especially at high dosages.

TOXIC EFFECT

A 5-week-old black male child who was given asafoetida has been diagnosed with methemoglobinemia. After receiving intravenous methylene blue therapy for the beginning of tachypnea, grunting, and cyanosis, he recovered. Consuming large amounts of asafoetida can cause headaches, anxiety, and mouth swelling in addition to digestive disorders including diarrhea and flatulence. During pregnancy, asafoetida ingestion is forbidden.

CONCLUSION

Based on the information found in the literature, asafoetida's phytochemical and biological properties make it suitable for use in a variety of medical applications. Additionally, it is frequently used as an aroma spice in a variety of meals all around the world. It has historically been widely used to treat a wide range of illnesses. A number of activities, including relaxant, neuroprotective, memory-enhancing, digestive enzyme, antioxidant, antispasmodic, hypotensive, hepatoprotective, antimicrobial, anticarcinogenic, anticancer, anticytotoxicity, antiobesity, anthelmintic, and antagonistic effect, have been demonstrated in recent studies of asafoetida's pharmacological and biological activities. Asafoetida has excellent medical value, however further research is still desperately needed.

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