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PHARMACOLOGICAL ACTIVITIES AND MEDICINAL USES OF RESINS OBTAINED FROM FERULA ASAFOETIDA: A REVIEW

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ABSTRACT

Asafoetida, which has a strong, persistent scent and a sulfurous taste, and oleo-gum-resin, a substance of medicinal and nutritional value, are both primarily derived from Ferula asafoetida Linn. As well as being used as traditional medicine around the world for numerous diseases, asafoetida is a taste agent in food. Numerous interesting properties have been discovered in recent investigations, mainly those that are muscle relaxants, memory enhancers, digestive enzymes, antioxidants, antispasmodic, hypotensive, hepatoprotective, anxiolytics, and anthelmintic. It is used to prevent and treat a variety of issues, including unplanned pregnancies, strange pain, sterility, and mostly female illnesses including painful and protracted menstruation and leukorrhea. Additionally, it is used to treat loose stools, gas, low stomach acid, and pressure in the stomach. This review examines several studies on.

Keywords: Leukorrhea, Anthelmintic, Ferula Asafoetida And Antispasmodic, Etc.

I. INTRODUCTION

Asafoetida (Ferula asafoetida L.) is the plant utilized for manufacture of dried latex (gum oleoresin) which is exuded from the rhizome and stems of this plant belonging to the family Umbelliferae. A milky secretion exudes from the cut surfaceof rhizome, stems and the dried exudates are scraped off. The plant grows 1-1.5 m tall and possesses extremely dissected leaves the inconspicuous yellow flowers have been kept in compound umbels. The bark is black and wrinkled which contains great amounts of gelatinous alliaceous juice.[1,2] The other species of Ferula, such as Ferula rigidula, Ferula rubricaulis, F. asafoetida, Ferula alliances, and Ferula narthex are other sources of Asafetida. [3-5] F. asafetida also grows wildly in the southern and central mountains of Iran. The oleo-gum-resin Asafoetida is called “Anguzakoma” “Anghouzeh,” and “Khorakoma” in Iran. Other names in some different languages are shown in Table 1. Asafoetida is an herbaceous perennial plant with an unpleasant odor that grows to about 2 m in height belonging to family Apiaceae**.**

The oleo-gum-resin is generally produced by incisions on the roots or by removal of the stems from the plant. Dried exudates (oleo-gum-resin) are collected and packed for export. Asafoetida occurs in two principal forms, mass and tears and mass form is the most common in the market.[3,6] Asafoetida consists of mainly three portions including gum (25%), resin (40-64%), and essential oil (10-17%). The resin portion contains coumarins, sesquiterpene coumarins, and ferulic acid; its esters and other terpenoids. The gum includes rhamnose, glucose, l-arabinose, galactose, glucuronic acid, polysaccharides, and glycoproteins. The volatile fraction contains monoterpenes, sulfur-containing compounds, and other volatile terpenoids.

II. METHODOLOGY

Marphology of asafoetida

The plant is a perennial herbaceous grass with quite thick and meaty roots, a stem that is 100 to 200 cm tall, and yellow flowers that bloom in umbellate groups near the stem's terminal. The fruit contains two dark-brown and dark-black oval-shaped seeds that are widely dispersed and have a foul scent.

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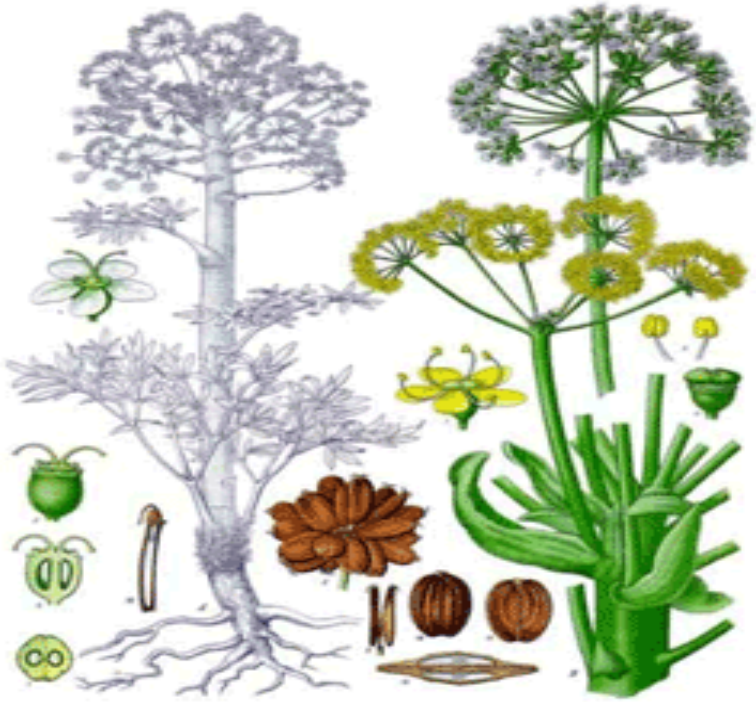

Fig. F. asafoetida

Taxonomy of F. asafoetida

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Family: Umbelliferae
Genus: Ferula
Species: Asafetida.

Common names

Name	Language
Kama, Anguza	Afghan
Shajarat-ul-Heltit, Angudan	Arabic
A-wei	Chinese
Duivelsdrek	Dutch
Asafetida, Stinking assa, Devil's dung	English
Pirunpaska	Finnish
Ase-fétide	French
Stinkender assand, Teufelsdreck	German
Hing, Hingu	Hindi
Ordoggyoker	Hungarian
Asafetida	Italian
Hing, Hingu	Nepali

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Kama, Anguza	Pakistan
Zapalniczka Cuchnace, Asafetida	Polish
Asafetida	Russian
Asa-fétida	Spanish
Dyvelsträck	Swedish
Seytan tersi, Seytan boku, Seytan out	Turkish

Chemical constituents

Asafoetida typically has 68% of its weight in carbohydrates, 16% of it in moisture, 4% of it in protein, 1% of it in fat, 7% of minerals, and 4% of it in fiber.[22] Asafetida consists of three primary components: gum (25%), resin (40-64%), and essential oil (10-17%).[5] Coumarins, sesquiterpene coumarins, ferulic acid and its esters, as well as various terpenoids, can be found in the resin part. One-arabinose, rhamnose, glucose, galactose, glucuronic acid, polysaccharides, and glycoproteins make up the gum component. Monoterpenes, substances containing sulfur, and other volatile terpenoids are all found in the volatile fraction.[23] Resin from F. asafoetida contains sulfur compounds that have a variety of biological effects and have potential medical applications.[24] One-(methylthio)-propyl-1-propenyl disulfide, 2-butyl-3-(methylthio)-2-propenyl disulfide, and 1-butyl-1-propenyl disulfide are the three principal sulfur components that have been identified.[5]

Pharmacological activities

Antidiabetic Activity

Due to insulin shortage, which affects 10% of the population, diabetes is a chronic, incurable disorder that is on the rise around the world.[25] The regulation of blood sugar is part of the action mechanism of asafoetida. It has been demonstrated that Asafetida's impact on the pancreas' secretory function results from their close relationship with the cell membrane. The pancreatic islet Langerhans beta cell receives the glucose through the transporter Glut-2, and during metabolism, adenosine triphosphate (ATP) is produced.[26] Finally, the Ca++ ion flow into the cytoplasm is ensured as a result of the ATP production's stimulation of insulin secretion by altering the membrane potential.[27] Calmodulin, which transports calcium in beta cells, is abundant in asafoetida. Other secondary messengers act to boost the beta cell's sensitivity to Ca++. Tyrosine kinase is stimulated by calcium, which causes insulin to be activated and secreted from the cell. Boiling water extract of oleo-gum-resin (IP) dosage 0.2 g/kg for 14 days utilizing Alloxan-induced diabetic rats was used to observe this activity.[13]

Antioxidant Activity

Free radicals are important in many illness disorders. Our bodies produce reactive oxygen species as a result of metabolic events, and these species have the power to harm vital biomolecules. Reactive oxygen species (ROS) can lead to disease situations if they are not efficiently scavenged by cellular components.[28] Antioxidant compounds can stop free radicals from acting in this way by scavenging them and detoxifying the body. Recently, it was revealed that the plant contains elements used in essential oils.[29] In this work, reducing power, linoleic acid and iron ion chelation power, antioxidant activity of the essential oil components from the F. asafoetida, and the utility of this plant were assessed in vitro using the 1,1-Diphenyl-2-picryl-hydrazyl (DPPH) and nitric oxide radical scavenging assay. In all the models examined, the extract from F. asafoetida's aerial parts demonstrated good, though varying degrees of antioxidant activity. These extracts demonstrated effective DPPH and nitric oxide radical scavenging abilities as well as good Fe++ chelation capabilities. Additional research on each chemical identifies the different antioxidant mechanisms at play.[30]

Anticancer Activity

On HEP-G2 cancer cell lines and the human breast cell line (MCF-7), it has been discovered that the aqueous and alcoholic extracts of Asafoetida, ginger, cinnamon, and cardamom had chemopreventive efficacy throughout an in vitro growth inhibitory experiment. Asafoetida, ginger, cinnamon, and cardamom were found to be cytotoxic agents against these tumor cells in both their aqueous and alcoholic extract forms. With these crude extracts, a drop in the population of HEP-G2 and MCF-7 cells was seen. Asafoetida has been shown in

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numerous studies to have tumor-reducing properties when administered orally to mice with Ehrlich ascites tumors and transplanted intraperitoneally.[31] The large concentrations of essential oils in F. asafoetida, which are poisonous to biological systems[29,32,33], as well as the essential oils of many Ferula species, may be the cause of the cytotoxicity. These bioactive secondary metabolites, including squiterpenes, coumarins, phenylpropanoids, and disulfide compounds, were isolated from F. asafoetida. Stylosin, a monoterpene derived from Festuca ovina, and mogoltacin, a sesquiterpene coumarin derived from Ferula badrakema, have been demonstrated to have lethal effects on tumor cell lines by enhancing cell apoptosis and generating DNA damages.[34]

The antibacterial and cytotoxic effects on human tumor cell lines are attributed to the sesquiterpene prenylated coumarin derivative ferulenol of Asafoetida, which is harmful to the plant. The root portion[35] contained the majority of the sesquiterpene coumarins, which may be considered as promising biological agents for the treatment of malignancies.[36] According to reports, F. asafoetida contains ferulic acid and farnesiferols, which can stop angiogenesis, VEGF-accelerated processes, and the formation of mouse Lewis lung cancer.[33] The methanol extract in this investigation is more cytotoxic than the ethanol extract. Using ethanol (516.1) and methanol (558.6) extractions, an extract of F. asafoetida resin produced yields of 0.752% and 2.390% w/w, respectively. These findings were consistent with a prior study, which found that absolute methanol had a higher yield than ethanol.[37] Aqueous and alcoholic extracts that were examined for in vitro cytotoxicity were also shown in some studies.[38] The findings demonstrated that aqueous extracts of the species were thought to be less cytotoxic to these cells than their alcoholic extracts. Due to the varied amount of flavonoid and polyphenolic contents, which are known to have antioxidant and chemopreventive activities, the aqueous extract has less inhibitory action than alcoholic extracts.[39,40]

Antispasmodic and Hypotensive Activity

In anesthetized normotensive rats, Fatehi et al. showed that F. asafoetida gum extract helped lower blood pressure. Mean arterial blood pressure in the rat was examined in order to determine the impact of gum extract on the contractile responses of the isolated guinea-pig ileum activated by histamine, acetylcholine, and KCl. When compared to control, a reduction in the average amplitude of the isolated guinea-pig ileum's contractions was seen. Acetylcholine-treated precontracted ileum exposed to F. asafoetida gum extracts relaxed in a dose-dependent manner.

In rats under anesthesia, the gum extracts significantly lowered mean arterial blood pressure. Additionally, it has been noted that F. asafoetida gum extract contains certain potent relaxant substances that block a variety of histamine, muscarinic receptor, and adrenergic actions, as well as the non-specific transport of calcium ions across membranes needed for smooth muscle contraction.[41]

Antiviral Activity

Asafoetida's in vitro antiviral effectiveness has recently been tested against a few HRV serotypes.[14] The cytopathic effects in HeLa cells caused by HRV-2 were reduced in this work by Asafoetida gum resin in a dose-dependent manner. The aforementioned investigation clarified the traditional medical usage of this gum resin in treating upper respiratory infections.[7]

Antifungal Activity

By using the disc diffusion method, the antifungal activity of essential oils derived from 20 different spices was assessed against Aspergillus niger, Candida albicans, Candida cylindracea, Candida tropicalis, Candida blank, Candida krusei, Candida glabrata, and Saccharomyces cerevisiae. The effectiveness of ketoconazole as a common medication was compared to the susceptibility of fungi to various kinds of essential oils. Asafoetida oil, one of the chosen spices, exhibited inhibitory activity against all fungal strains, with strong activity toward Candida tropicalis, Candida albicans MTCC-227, S. cerevisiae, and A. niger and moderate activity toward Candida blanki, Candida glabrata, Candida krusei, Candida cylindracea, Candida albicans MTCC-3017, and Candida albicans NCIM-3100. All test fungus except one had their growth significantly suppressed by asafoetida oil.[16] In dual culture tests on an agar medium, the antifungal and allelopathic effects of various doses of methanolic extract of Asafoetida oleo-gum-resin against Pleurotus spp. and Trichoderma harzianum were assessed. At the higher doses, it displayed fungistatic and fungicidal effects against T. harzianum and Pleurotus

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spp.[42] For in vitro testing against Sclerotium rolfsii ITCC 5226 and Macrophomina phaseolina ITCC 0482, formulations including neem oil, nicotinic acid, and F. asafoetida with, and -unsaturated carbonyl compounds were investigated at various doses. These formulations, which contain F. asafoetida as a natural product at a dose level of 66 mg/L, could be a beneficial addition to existing methods for controlling pathogenic fungus.[15,43] Based on a totally randomized design and an in vitro method, Mostafa et al. discovered the antifungal action of essential oil from Asafoetida seed on some of the plant pathogenic fungus, including Bipolaris sorokiniana, Fusarium graminearum, Verticillium sp., A. niger, and Fusarium solani. All of the examined fungal species saw a considerable growth inhibition from the essential oil from Asafoetida seed when compared to controls. The essential oil from Asafoetida seeds completely prevented the growth of B. sorokiniana, although it was significantly dose dependent for other species.

Antifertility Activity

It has been observed that different extracts of F. asafoetida demonstrated post-coital antifertility effects. In 80% of adult Sprague-Dawley rats, post-coitus pregnancy was prevented by the methanolic extract of F. asafoetida resin at a dose of 400 mg/kg daily, according to Keshri et al. In addition, when given in combination with polyvinylpyrrolidone, the aforementioned amount completely prevents conception in rats.[45]

Hepatoprotective Activity

According to Dandagi et al., some extracts, including those from Nardostachys jatamansi, Momordica charantia linn, and F. asafoetida, have hepatoprotective properties against experimentally induced hepatotoxicity. Benzene, chloroform, petroleum ether (60–80), ethanol, and aqueous extracts of F. asafoetida, M. charantia Linn, and N. jatamansi were tested for their individual hepatoprotective effects against carbon tetrachloride-induced liver damage in Wistar rats. The aforementioned extracts were made into polyhedral suspensions, and the hepatoprotective properties of each suspension were examined by measuring the levels of blood enzymes such glutamate pyruvate transaminase, glutamate oxaloacetate transaminase, and alkaline phosphatase. It was also distinguished that administration of polyhedral suspension reduced the serum enzyme levels. The biochemical observations were further supplemented by the histopathological examinations of liver sections. The experimental data indicated that polyhedral suspension of the extracts exhibited promising activity against the carbon tetrachloride-induced hepatotoxicity.[46]

Antiulcer Activity

On several ulcer-induced models using Wistar albino rats, the antiulcer activity of an asafoetida aqueous suspension produced in 1% carboxymethyl cellulose in water was assessed. In comparison to indomethacin, which was employed as the standard, pylorus ligation caused stomach ulceration in rats. Narcotizing drugs such as 80% ethanol, 0.2 M NaOH, and 25% NaCl were also utilized to cause gastric ulcers. After suspension was administered, all models showed a notable improvement in protection. The aforementioned findings were corroborated by a histopathological evaluation of the stomach's gastric tissue, a measurement of the amount of gastric wall mucus (GWM), which showed improved protection for a number of indices, and a suspension treatment to restore the GWM level that had been depleted.[47,48]

Memory Enhancing Activity

The main sign of Alzheimer's disease in the majority of sufferers worldwide is manifestations of memory loss. The impact of the F. asafoetida extracts on rat learning and memory was examined by Vijayalakshmi et al. in 2012.[49] After giving two oral doses (200 and 400 mg/kg) of F. asafoetida aqueous extract with rivastigmine as a positive control, the memorization and learning were assessed using elevated plus maze and passive avoidance paradigm. In the raised plus maze paradigm, the extract resulted in a significant improvement in memory score and a dose-dependent improvement in transfer resins. Using the pentylenetetrazole (PTZ) kindling method, the antiepileptic and antioxidant activities of the F. asafoetida gum extract were studied.

Following the injection of plant extracts, treatment groups showed significantly lower MDA and NO levels and higher SOD levels when compared to the PTZ group. Due to its antioxidant qualities, F. asafoetida gum extract presumably reduces oxidative damage and lipid peroxidation. The hydroalcoholic F. asafoetida gum extracts' ability to reduce PTZ-induced seizures is most likely a result of its antioxidant qualities and ability to reduce oxidative stress.

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Digestive Enzyme Activity

Due to enzymatic involvement in digestion, spices have generally improved gastric juice output, salivary flow, and support for the digestive process. The potential impact of some common spices or active ingredients on the pancreatic digestive enzymes in experimental rats was assessed. 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 given to the animal groups for 8 weeks as part of their spice diets. Asafoetida significantly increased pancreatic lipase activity and promoted pancreatic amylase among these spices.

The well-known digestive stimulating action of spices may be influenced by the beneficial effects of the pancreatic digestive enzymes exerted by many of the spices taken in the diet.[11] Rao et al. also looked at the effects of Asafoetida and 14 other spices in a reaction blend with two different doses on the digestive enzymes of rat pancreas and small intestine. When they have a direct impact on the enzyme, most spices increased pancreatic lipase and amylase activity.[51]

Anxiolytic Effect and Anthelmintic Activity

Alqasoumi (2012) used a hot plate, a motor activity meter, and an elevated plus maze to discuss the analgesic, sedative, and anxiolytic properties of asafoetida in mice. As a conventional anxiolytic, diazepam was utilized. According to the findings, asafoetida has a dose-dependent anxiolytic and analgesic effect with a sedative effect at high doses. The Asafoetida appears to be a more effective treatment for anxiety disorders. Asafoetida in low doses can be utilized as a therapeutic substitute for the currently prescribed anxiolytic medications.[52,53] By measuring the length of the worm's paralysis and its time to death, Gundamaraju (2013) examined the anthelmintic activity of three different concentrations of aqueous extract of F. asafetida against Pheretima posthuma. At the highest dose of 100 mg/mL, the extract exhibited notable anthelmintic action. In comparison to piperazine citrate, it has also demonstrated better expressive activity.[54] The effects of dried Allium sativum clove powder were investigated by Kumar and Singh. When treating the liver fluke Fasciola gigantica, F. asafoetida dried latex powder and flower extract are preferred over dried powder of Syzygium aromaticum. At the same time-concentration and in a time-dependent manner, the anthelmintic activities of all three plants were assessed. Compared to other organic extracts, ethanol extract was more hazardous. F. asafoetida's ethanol extract was extremely poisonous to F. enormous. As a strong helminthicide, dried root latex powder of F. asafoetida may be used.

Adverse effect

After consuming asafoetida, a 5-week-old black male newborn developed methemoglobinemia. Tachypnea, grunting, and cyanosis were the first symptoms, and methylene blue administered intravenously helped locate him.[61] When asafetida is consumed in large doses, it can cause headaches, nervousness, and digestive issues like flatulence and diarrhea. Prescriptions for asafetida use are safe to make while pregnant.[62]

III. CONCLUSION

According to the literature, asafetida's pharmacological actions allow it to be utilized as a variety of medications. Historically, asafoetida has been used extensively to treat a wide range of illnesses. It is also commonly used as an aroma spice in many meals all over the world. It is used to treat a variety of issues, including unintended pregnancies, strange pain, sterility, and specifically female illnesses including problematic and frequent menstruation and leukorrhea. Recent pharmacological investigations have also demonstrated that asafoetida has a wide range of therapeutic effects, including those that are sedative, neuroprotective, memory-improving, digestive enzyme, antioxidant, antispasmodic, hypotensive, hepatoprotective, antibacterial, anticancer, and anthelmintic. Even though asafoetida has incredible therapeutic value, thorough research to look for new chemical ingredients is still desperately needed.

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