



***Ferula asafetida* (Hing): A Review Based Upon its Ayurvedic and Pharmacological Properties**

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ABSTRACT

Ferula is considered as the third largest genus of the family *Apiaceae* (*Umbelliferae*) which consists of 180-185 species. Asafoetida is defined as the oleo-resin gum extracted from the stem and rhizome of the *Ferula asafetida* plant. It is commonly called Hing or Devil's dung. It is a native species of Iran, Afghanistan and Pakistan. In Ayurveda, it is described as an analgesic agent and is mentioned in Charak Samhita. It carries a strong, tenacious and sulfurous odor. It is also used as a spice or as a condiment in various cookeries as a flavor like in curries, fresh vegetables, meat, pickles and pulses. Asafetida is distinguished as asafetida hing (hing) and asafetida (hingra). Traditionally, the plant is used to treat diseases like whooping cough, asthma, bronchitis, epilepsy, ulcer, stomachache, flatulence, bronchitis, antispasmodic, intestinal parasites, influenza and weak digestion. The main active constituents present in the *Ferula asafetida* plant are resins, gums and essential oils. From the reported studies it was found that the plant possesses various therapeutic and pharmacological properties like antioxidant, antimicrobial, antifungal, antiviral, antitumor, antimicrobial, antidiabetic, antispasmodic, hypertensive, hepatoprotective, neuroprotective and antiviral properties. In this review article, attempts have been made to describe the overall plant based on its modern and traditional view.

Keywords: Hing, *Ferula asafetida*, Rasapanchak, Ayurveda.

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INTRODUCTION

The use of herbal medicines is increasing in today's world because of their fewer side effects and less toxicity than allopathic medicines¹. There are about 20,000 medicinal plant species reported in India out of which 800 plant species are used by more than 500 traditional communities to cure variety of diseases². There are about 25,000 effective plant formulations made from these herbal plants that are used as folk medicine by the rural communities of India. About 1.5 million practitioners use these medicinal plants in preventive, promotional and curative applications. There are estimated to be 7800 medicinal drug-manufacturing units in India, in which 2000 tons of herbs are consumed annually. The drugs derived from these herbal plants are used in the modern formulations of the medicines³.

Ferula asafetida (figure no. 1) is commonly known as asafetida or devil's dung. In India, it is commonly called as Hing or Hingu. It is an oleo-gum-resin that is produced by the incisions on the roots or by scraping off the stem of the genus *Ferula* such as *Ferula alliacea*, *F. asafetida* L., *F. foetida* Regel that belongs to the *Apiaceae* (*Umbelliferae*)

family.⁴ Hing is derived mainly from the *Ferula asafetida* and *F. alliacea* species of the genus *Ferula*.



Figure 1 *Ferula asafetida* (Hing)

The name *Ferula* is derived from a Latin word which means 'carrier' or vehicle where *Asa* is Latinized from Farsi *asa* which means 'resin' and *Foetidus* means 'smelling, fetid'. Asafoetida is available in two principal forms i.e. in mass form and tear form in which the mass form is the commonest type and easily available in the market^{5,6}. Asafetida is distinguished as asafetida hing (hing) and asafetida (hingra).⁷ The plant carries a strong, tenacious and sulfurous odor. It is used as a flavoring agent in curries, meatballs, pulses and pickles. In India, Asafetida is used as a strong ingredient in Indian cuisine because of its odor which is similar to the garlic and onion flavor and is also used in meat⁸. Ancient Romans used to store Asafetida in jars with pine nuts, which is used as a flavor in delicate dishes which enhances the taste in mushroom and



vegetable dishes and adds a unique flavor to barbecued or fried meat. It is utilized in dissolved, solid and in powder form. In Ayurveda, it is used as an appetizer and is used to restore consciousness. The plant is also utilized as an antidote for opium. Traditionally, the plant is used to treat a variety of diseases like whooping cough, stimulates the intestinal, nervous and respiratory system, asthma, epilepsy, ulcer, stomachache, flatulence, bronchitis, antispasmodic, intestinal parasites, influenza and weak digestion^{9,10,11}. In Europe and the United States, Hing is used in perfumes and flavoring. Also, it is used as an effective treatment against women to cure problems like unwanted abortion, abnormal pain, sterility, painful menstruation and leucorrhoea. The active constituents of the Asafetida plant are mainly resins (40-64%), gum (25%) and essential oil (10-17%). Due to the presence of phytochemical constituents, it carries various therapeutic and pharmacological properties like antioxidant¹², antimicrobial^{13,14,15,16}, antifungal^{17,18,19,20}, antiviral, antitumor²¹, antimicrobial, anti-diabetic²², antispasmodic, hypertensive²³, hepatoprotective, neuroprotective²⁴ and antiviral properties^{25,26}. The vernacular name and toxicological classification are shown in table no. 1 and table no. 2 respectively.

Table 1: Vernacular Names of the *Ferula asafoetida*

Language	Folk names
Arabic	Tyib
Marathi	Hing
Gujarat	Hing
Kashmiri	Yang-sap
Malayalam	Kayam
Tamil	Perungaayam
Oriya	Hengu
Sanskrit	Badika
Telugu	Inguva
Turkish	Seytan, tersi, Seytan boku, Seytan out
Swedish	Dyvelstrack
Spanish	Ase-fetida
Russian	Asafetida
Pakistan	Kama, Anguza
Nepali	Hing, Hingu
Italian	Asafetida
Hindi	Hing, Hingu
German	Stinkender assand, Teufelsdreck
French	Ase-fetida
English	Asafetida, Stinking assa, Devil's dung
Dutch	Duivelsdrek
Chinese	A-wei
Afghan	Kama, Anguza

Table 2: Taxonomical Classification of *F. asafoetida* plant²⁷

Taxonomical rank	Taxon
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Family	<i>Umbelliferae</i>
Genus	<i>Ferula</i>
Species	<i>Asafoetida</i>
Common name	Hing, Hingu

Botanical Description of *F. asafoetida* Plant

F. asafoetida is herbaceous, monoecious, perennial herb that belongs to the family *Apiaceae* (*Umbelliferae*). The plant has a fetid smell due to the presence of sulfur constituents. Asafoetida or Hing is the dried latex or oleo gum resin extracted from the rhizomes or roots of this perennial herb. The height of this plant reaches up to 2m with a bunch of leaves present in the circular form²⁸. Roots are massive, thick and pulpy. The outer bark of the root is blackish and wrinkled while it is fleshy, white, containing thick milky, fetid alliaceous juice from the inner surface. The leaves of the plant are shiny, oblong, pinnate that grows up to 45cm in length. The stem is 2.5-3m long, short, stout, hollow, 10cm thick, succulent solid, smooth, herbaceous containing several ducts in the cortex that possesses resinous gum. The leaves are tripinnate with a length of 30-40cm. Flowers are flat, thin and pale yellow²⁹. The fruits are oval, reddish-brown, thin, large, dark, slightly hairy, rough which is 0.8 cm long and 0.6 cm in breadth containing a milky juice. The white exudate of the fruit is pure, crystalline and fragrant. Commercial Asafoetida is isolated from the root part of the plant. The taproots of the plant are the carrot-like bearing diameter of 12-15 cm at the crown after 4-5 years³⁰.

Geographical Distribution of *Ferula asafoetida* Plant

Ferula asafoetida plant is a native species of the Mediterranean region and central Asia that grows at an altitude of 600-120m above sea level^{31,32}. It is distributed in the mountain region of Afghanistan, Kashmir³³, Europe, Turkey, North Africa and Iran³⁴. It is mainly grown in sandy soils. Even though it is not the native species of India but still, the plant has been used for ages as a cookery agent and play a significant role in medicinal practice.

Phytochemical Constituents of the *Ferula asafoetida* Plant

There are various chemical constituents present in the *Ferula asafoetida* plant includes carbohydrates (68%), moisture (16%), protein (4%), fats (1%)³⁵, minerals (7%) and fibers (4%)³⁶. The major chemical constituents consist of three main fractions which include resins (40-64%)³⁷, gums (25%) and essential oil (10-17%). The phenolic compound and diterpenes are also present in the *F. asafoetida* plant which includes vanillin³⁸, 3,4-



dimethoxycinnamyl-3-(3,4-diacetoxyphenyl) acrylate, picealactone C, 7-oxocallitric acid³⁹.

Resins

Resins include coumarins, sesquiterpene coumarins, ferulic acids and their esters, and other terpenoids. The coumarin⁴⁰ and sesquiterpene⁴¹ constituents include umbelliprenin, 5-hydroxyumbelliprenin, 8-hydroxyumbelliprenin, tadshiferin, galbanic acid, 8-acetoxy-5-s-hydroxyumbelliprenin, conferol, gummosin, epi-samarcandin, epi-samarcandin acetate, franesiferol⁴², Asacoumarin. Assfoetidin, ferrocalicin, assafoetidinol A and B, polyanthinin, komolonol, foetidine, saradaferin. 10-R-acetoxy-11-hydroxyumbelliprenin, 10-R-karatavicinol, methyl galbanate, lehmferin, feselol, ligupersin A, epi-conferdione, microglobulin, umbelliferone⁴³, taraxacin, fetidone A and B^{44,45}.

Gums

It includes glucose, rhamnose, galactose, 1-arabinose, glucuronic acid, polysaccharides and glycoproteins⁴⁶.

Volatile oil

The volatile fraction contains a sulfur-containing compound which includes 2-butyl 1-propenyl disulfide, 1-(methyl thio)-2-propenyl disulfide, 2-methyl-2-propanethiol, 2-butyl 3-(methylthio)-2-propenyl disulfide, 2,3-dimethylthiirane, s-methylpropanethioate, dimethyl trisulfide, dipropyl disulfioetisulfide A and C, monoterpenes and other volatile terpenoids that are responsible for biological activities⁴⁷.

The other compounds found in the Asafetida plant includes oleic acid⁴⁸, beta-sitosterol⁴⁹, falcariolone, arabinose, rhamnose, ferulic acid, luteolin 7-beta-D-glucopyranoside and glucuronic acid. The structures of some major phytochemical constituents are shown in figure 2.

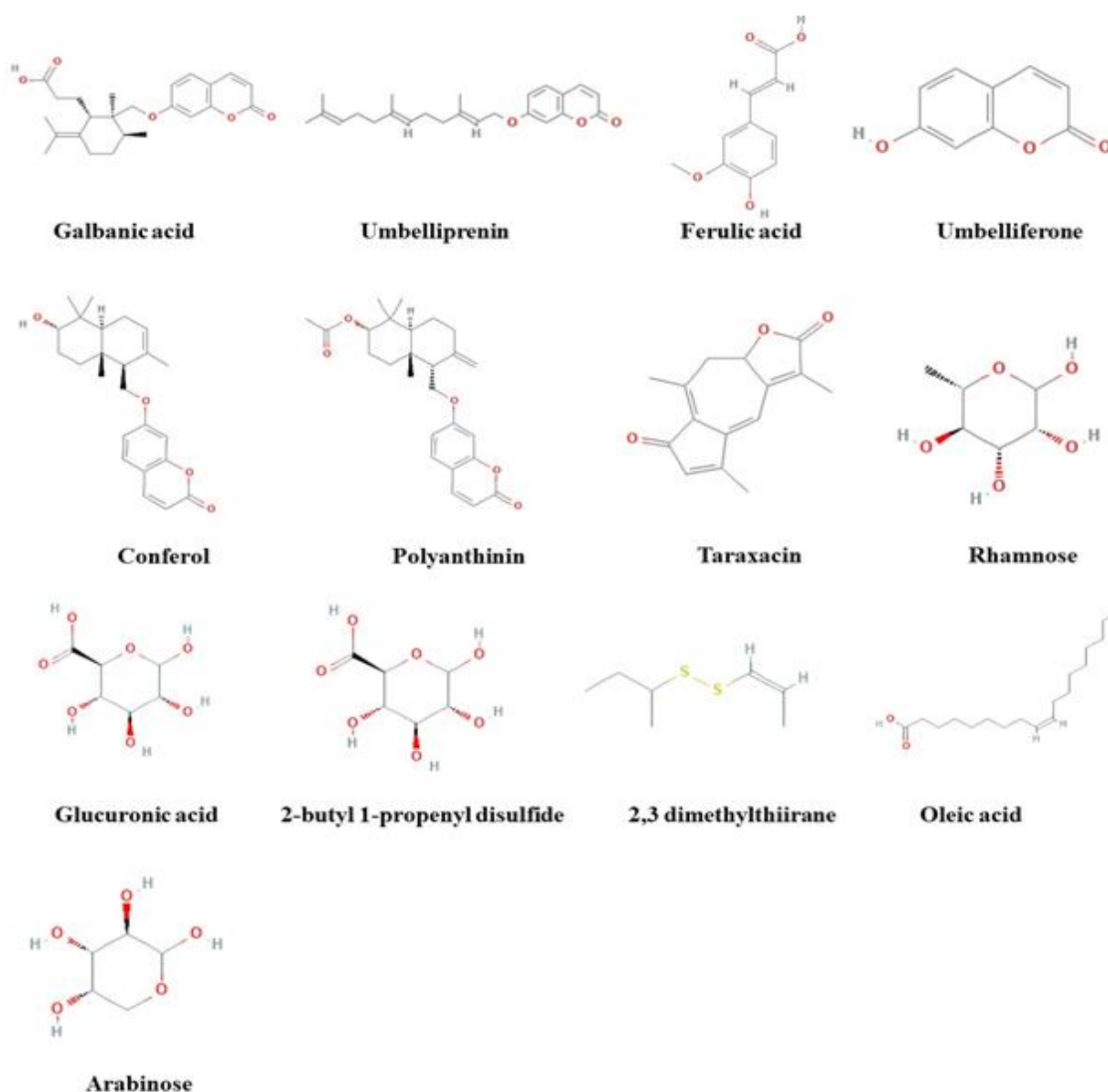


Figure 2: Chemical structures of some major phytochemical structures of *Ferula asafetida* plant

Traditional and Modern View

a) Ayurvedic view

Ferula asafetida is considered as the most important remedial plant in Ayurveda. *F. asafetida* plant has a characteristic sulfurous odor and has a bitter taste. In Ayurveda, it is used to treat gastrointestinal disorders and is useful as an effective remedy against flatulence⁵⁰. It is used in roasted form because the unprocessed asafetida causes irritation and inflammation⁵¹. It is used to treat nervous disorders and is considered an effective remedy for hysteria. It is also useful as an aphrodisiac agent and is used to treat impotence⁵². It balances the Kapha and Vata dosha and increases Pitta dosha. It is used to treat diseases like impotence, whooping cough, asthma, skin disorders, gastrointestinal disorders like stomachache, acidity, nerve disorders, reproductive disorders and is used as a carminative, diuretic and laxative agent. The rasapanchak (properties) of the plant is shown in table no. 3.

Formulations of *F. asafetida*: Hingvadivati, Hingvashtak churan, Hingurkapur vatika, Rajahpravartani vati⁵³.

Table 3: Rasapanchak (properties) of *F. asafetida* plant

Sanskrit / English	Sanskrit / English
Veerya / Potency	Ushna / Hot
Vipak / Metabolic property	Katu / Bitter
Guna / Physical property	Laghu / Light, Snigdha / Oily, Tikshna / Astringent
Rasa / Taste	Katu / Astringent

Actions and properties of the *F. asafetida* plant^{54,55}

Pittavardhak: It increases the Pitta dosha due to its hot potency.

Kaphavatashamak: It balances the Kapha and Vata dosha.

Vedanasthapan: It is used in paste form which helps in relieving pain.

Shoolprashanan: It reduces edema.

Deepan: It is used as an appetizer

Anuloman: It is used to cure flatulence problems.

Krimighna: It is used to cure anthelmintic agents.

Vaajikaran: It is used as an aphrodisiac agent.

Aartjanan: It is used to improve female reproductive health.

Balya: It helps in brain strengthening.

Jwarghna: It is used as an antipyretic agent.

Sheetprashanan: It helps in maintaining homeostasis.

Sangyasthapan: It is used to restore consciousness.

Kaas-shvash: It is used to cure respiratory disorders like whooping cough, asthma and bronchitis disorder.

Udarshool: It is used to prevent stomach ache disorder.

Gulam: It is used to cure gynecological disorders like UTI, menstrual problems, etc.

Hridroga: It helps in treating cardiac or heart-related diseases or disorders.

Jeenshvaas: It is used against chronic disorders.

Mutraghaat: It is used to treat painful micturition and is used as a diuretic agent.

b) Folk uses

The *F. asafetida* plant is used to treat various types of diseases. It helps in treating gastrointestinal disorders and is used mainly in the roasted form. In the eastern region of Shimoga of India, it is used to cure stomachache⁵⁶. It is used as a condiment in various dishes as well in meat. Traditionally, it is used as an antibacterial, antispasmodic, diuretic and as a laxative agent in India⁵⁷. The water extract of the dried gum of the *F. asafetida* plant carries anthelmintic property^{58,59,60}. In Afghanistan, the hot water extract of the dried gum is used to treat hysteria, whooping cough and ulcers⁶¹. In China, the infusion of the plant is used to treat vermifuge when taken orally⁶². In Brazil, the oleoresin powder is used as a condiment in a crushed form⁶³. The oral administration of the hot water extract of the dried leaf and stem of the plant is used as an aphrodisiac agent in males and its extracts are also used as a general and nerve tonic⁶⁴. 52% of the Egyptian people used the dried gum of the plant as a contraceptive agent⁶⁵. They applied the dried gum vaginally before or after the coitus. The oral administration of the decoction prepared from dried root is used as an antispasmodic, diuretic, a vermifuge and as an analgesic agent⁶⁶. Fiji people use the dried resin of the plant in paste form to treat whooping cough (application of the paste over the chest). Asafetida plant is also used to cleanse a new mother with *Allium sativum*. The decoction of the dried resin is used to treat stomach problems⁶⁷. In India, the dried extracts of the *F. asafetida* along with Brassica alba and rock salt when diluted with vinegar are used as an abortifacient agent when taken orally⁶⁸. The decoction of the dried gum is used as a carminative, antispasmodic and as an expectorant in chronic bronchitis diseases. It is also used to treat cholera when mixed with cayenne pepper and sweet flag⁶⁹. The dried gum resin in the paste form is taken orally to anticipate guinea worm disease⁷⁰. Gum resins are used to cure stomachache when applied externally with salt and the bark juice of *Moringa pterygosperma*⁷¹. It is also used to cure diseases like gallstones, kidney stones and the hot water extract of the dried resin is administered orally as an emmenagogue^{72,73}. In Malaysia and Morocco, the gum is chewed by the females for amenorrhoea and is used as an antiepileptic^{74,75}. Nepal people used the water extract of the resin as an anti-helminthic agent⁷⁶. Saudi Arabia people used the dried gum of the *F. asafetida* plant against



whooping cough, asthma and bronchitis⁷⁷. The fluid extract of the plant is used by the US people as a stimulating expectorant, an anthelmintic, aphrodisiac, as a stimulant to the brain and nerves and as an antispasmodic agent⁷⁸.

c) Modern view

Adulteration is the major problem faced by the herbal drug industry in the present scenario. It is not only affecting the herbal drug industry but also the life of a well –being⁷⁹. Adulteration can be done by substitution or addition of the toxic materials which results in the degradation of the quality of the original herbal medicines⁸⁰. Due to the increased demand for herbal products, the risk with the herbal medicines also rises as the quality of the end product compromises because of the contaminated raw material with toxic metals, microbes, and other residues, adulteration (addition of fake or inferior plant material, orthodox drugs, foreign material) which results in the poor quality of raw material and end product. Lack of standardization techniques is also responsible for the poor quality of drugs as it fails to detect the original drug which exploits its usage in the conventional system of medicines. So, it is necessary to develop an Herbal Authentication System (HAS) which can serve as a regulator and also helps in improving the quality of herbal trade⁸¹.

Reported Therapeutic and Pharmacological Properties of *F. asafetida* Plant

Ferula asafoetida is the most significant herbal plant which is used to treat a variety of diseases. The phytochemical constituents present in the plant are responsible for various pharmacological and therapeutic properties. Some of the reported studies on its therapeutic properties are discussed below. Table no. 4 represents the therapeutic and pharmacological properties of the *F. asafetida* plant.

Antibacterial: It was evaluated that the dried gum resin component of the *F. asafoetida* plant showed antibacterial activity when tested against *Clostridium perfringens* and *Clostridium sporogenes* on agar plate⁸².

Anti-carcinogenic: To identify the anti-carcinogenic activity of the *F. asafoetida* plant, the dried resin of the plant was given orally to Sprague-Dawley rats at the dosage of 1.25 and 2.5% w/w of the diet. A significant reduction in the multiplicity and size of palpable N- methyl -N-nitrosourea-induced mammary tumors and delay in mean latency period of tumor appearance was observed⁸³.

Anticholesterolemic: The test was carried out on a rat model to detect the anticholesterolemic activity of the *F. asafetida* plant. The resin was administered orally at a dosage of 1.5% to rats fed with an atherogenic diet, which failed to reduce the serum cholesterol levels⁸⁴.

Antifertility: The methanolic extract of the *F. asafetida* plant was tested against Sprague-Dawley rats at a dosage of 400mg/kg daily prevented post-coitus pregnancy in 80% of the adult Sprague-Dawley rats up to 1-10 days' duration. It was also detected that the methanolic extract restricted pregnancy in 100% of the rats when administered along with polyvinylpyrrolidone⁸⁵.

Antifungal: It was reported that the essential oil extracted from the *F. asafetida* plant showed antifungal activity against different fungal strains. The ethanolic extract of the plant was found active on the agar plate⁸⁶. The essential oil extracted from the rhizome at 400 ppm concentration showed an effect against *Microsporum gypseum* and *Trichophyton rubrum* and showed weak activity against *Trichophyton equinum*⁸⁷. The asafetida extract at a concentration of 5-10 mg showed inhibitory activity against *Aspergillus parasiticus* aflatoxin production⁸⁸.

Antihypertensive: It was reported that the aqueous extract extracted from the dried gum resin when administered intravenously to dogs at different doses showed antihypertensive activity⁸⁹.

Anti-parasitic: The oleo-gum resin extracted from the root and stem of the plant showed anti-parasitic activity when tested against *Trichomonas vaginalis*⁹⁰.

Antioxidant: The extracts of the Asafoetida plant showed antioxidant activity when tested against Sprague-Dawley rats. The extract was administered orally at the dosage of 1.25% and 2.5%. Results showed inhibition in lipid peroxidation as measured by thiobarbituric acid-reactive substances in the liver of rats⁹¹.

Antitumor: The aqueous extract isolated from the dried oleoresin of the plant was given by gastric intubation to mice at a dosage of 50 mg/animal daily for 5 days was active on CA-Ehrlich ascites, and 53% increase in life span was observed⁹².

Anti-hyperglycemic: The hypoglycemic activity of the plant was evaluated in the streptozotocin-induced diabetic rats. The plant extract was administered at a dosage of 50 mg/kg for 4 weeks. Results showed significant hypoglycemic activity in streptozotocin-diabetic rats during the 2nd week and 4th week of the treatment period⁹³.

Anti-inflammatory: The ethanolic extract of the plant isolated from the resin showed an anti-inflammatory effect when tested in two groups of 50 patients with an irritable colon⁹⁴.

Antispasmodic: From the reported study it was found that the gum extract of *F. asafetida* plant helps in reducing blood pressure when tested in anesthetized normotensive rats⁹⁵. Reported therapeutic and pharmacological uses of *F. asafetida* plant are listed in table 4.



Table 4: Reported therapeutic and pharmacological uses of *F. asafetida* plant

S. No.	Extract	Method <i>In vivo / in vitro</i>	Pharmacological activity	Reference
1.	Dried gum resin extract	<i>Clostridium perfringens, Clostridium sporogenes</i>	Antibacterial	82
2.	Resin extract	Sprague-Dawley rat	Antricarcinogenic	83
3.	Resin extract	Rat model	Anticholesterolenic	84
4.	Methanolic extract	Sprague-Dawley rats	Antifertility	85
5.	Ethanollic extract	<i>Microsporium gypseum, Trichophyton rubrum, Trichophyton equinum</i>	Antifungal	86,87,88
6.	Aqueous extract	Dogs	Antihypertensive	89
7.	Oleo-gum resin extract	<i>Trichomonas vaginalis</i>	Antiparasitic	90
8.	Asafetida extract	Sprague-Dawley rat	Antioxidant	91
9.	Aqueous extract	Mice model	Antitumor	92
10.	Plant extract	Diabetic rat	Antihyperglycemic	93
11.	Ethanollic extract	Clinical study (50 patients)	Anti-inflammatory	94
12.	Gum extract	Rat model	Antispasmodic	95

Toxicity: A large dosage of asafetida can cause swelling of the mouth, digestive illnesses like diarrhea, flatulence, anxiety and headache. The intake of asafetida is restricted during pregnancy⁹⁶. A case was registered that is of methemoglobinemia where asafetida was taken for 5 weeks by the old black male infant. The patient was recovered after giving him the intravenous methylene blue treatment from the onset of tachypnea, grunting and cyanosis⁹⁷.

CONCLUSION

Asafetida is the oleo-gum resin extracted from the exudates of the rhizomes and stem of the plant species *Ferula asafetida*. It is used as a condiment in various regions of the world which provides a great flavor in cookery items like curries, meat, vegetables and other food items. From the reported studies, it is clear that the Asafetida plant contains various phytochemical constituents like sesquiterpene coumarins that play a vital role in the pharmaceutical and industrial applications to produce modern herbal formulations. Besides this, the plant is used traditionally to treat several ailments like cough, asthma, gastrointestinal disorders, impotency, fever, epilepsy, paralysis and many more. In Ayurveda, the asafetida plant plays a significant role as it contains various medicinal properties and is used by several ayurvedic practitioners to treat diseases like asthma, bronchitis, infertility, reproductive problems, flatulence, stomachache, analgesic, digestive disorders, etc. Various studies on the asafetida plant showed that the plant possesses various therapeutic and medicinal properties like antioxidant, antidiabetic, hypertensive, antifungal, antibacterial, anti-tumor, antiviral, antispasmodic and many more.

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