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Review article

A review on pharmacological actions of *Ferula asafoetida* oleo-gum-resin (hingu) in the management of abdominal pain

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ABSTRACT

Albeit the fact that *Hingu* (the oleo gum resin) is a popular kitchen spice and Indian folklore medicine for gut disorders, it's a role in abdominal pain is greatly challenged in the shade of contemporary science researches. Being the easy availability even in your kitchen, it can be the best option to treat abdominal pain even in acute conditions. Several analytical & experimental works have been performed to substantiate the various pharmacological actions of *Hingu*, out of which many are related to abdominal pain relief. Here we reviewed such studies and put out such actions which may be very helpful to establish *Hingu* as the potent abdominal pain-relieving drug from the views of contemporary researches. Purpose of this article is to provide a scholarly review of research studies related to pharmacological actions of *Hingu* responsible for abdominal pain relief and to establish the fact that *Hingu* is a potent drug for abdominal pain. The review centralizes on published research articles in the MEDLINE, PubMed, ScienceDirect and Scopus. Search criteria included research articles and publications written in English with keywords *Hingu,* Oleo gum resin, *Shool*, Abdominal pain. From the vivid overview and discussion, we conclude that *Hingu* has sufficient potency to encounter most of the mechanisms responsible for abdominal pain.

INTRODUCTION

Abdominal pain is discomfort that is felt in the part of the trunk in between ribs and pelvis which comes from organs within the abdomen or organs adjacent to the belly. It is associated with both serious and non-serious medical issues. Common causes of pain in the abdomen include gastroenteritis and irritable bowel syndrome. About 10% cases have a more serious underlying cause like appendicitis, leaking and ruptured abdominal aortic aneurism, diverticulitis or ectopic pregnancy, In a third of cases, the exact cause is unclear (Viniol et al., 2014). Some other causes also contribute to abdominal pain such as ulcerations, helminths, spasm, etc. Not only in Ayurveda but in different medical systems several herbal origin drugs have been used for a long time to manage abdominal pain. *Hingu*, the oleo gum resin of *Ferula asafoetida* is one of such drugs which is in practice not only by physicians but as a home remedy too. Besides many other pharmacological activities, various actions have been researched out which shows that *Hingu* has a potent efficacy to manage abdominal pain. Hence, the present review comprises of the compilation and elaboration of scientific research as well the critical analysis of classical texts based on the *Hingu*.

CHEMICAL CONSTITUENTS

Ferula asafoetida contains carbohydrates 67.8% per 100 g, moisture 16.0%, protein 4.0%, fat 1.1%, minerals 7.0% and fiber 4.1%. Its mineral content includes iron, phosphorus, substantial calcium and vitamin contents include carotene, riboflavin and niacin. Its calorific value is 297, contains 40-64% resinous material composed of ferulic acid, umbelliferone, farnesiferols A, B, and C, asaresinotannols etc. About 25% gum composed of rhamnose, galactose, glucose, arabinose and glucuronic acid. The volatile oil (3-17%) consisting of disulfides as its major components, notably 2-butyl propenyl disulfide (E-and Z-isomers) with monoterpenes (α- and β-pinene, etc.), valeric acid, free ferulic acid, and traces of vanillin. The disagreeable odour of the oil is reported to be mainly due to the disulphide $C_{11}H_{20}S_{22}$. It also contains triterpenoids and saponins. Asafoetida consists of resin (40-64%), gum (25%) and essential

oil (10-17%) as three main constituents. Various sesquiterpene coumarins present in asafoetida are assafoetidnol A and assafoetidnol B. There are various newly isolated sesquiterpene coumarins which are colladonin, epiconferidone, 8-acetoxy-5-hydroxylumbelliprenin, karatavicinol and asacoumarin. Free ferulic acid is present in the oleo-gum-resin. Free umbelliferone is absent in the drug which is a unique characteristic as compared to galbanum. Ferulic acid action with hydrochloric acid is changed into umbellic acid that further loose water to form umbelliferone. Galbanic acid is also one of the usually present sesquiterpenes in the resin portion of the drug (Kareparamban et al., 2012).

PHARMACOLOGICAL ACTIVITIES

Ferula asafoetida possess a wide range of pharmacological activities which includes actions like antidiabetic, anticancer, antifertility, memory enhancing, hypotensive, etc. (Table 1) along with following pursuits.

Table 1. Pharmacological activities shown by *Ferula asafoetida* (hingu)

Pharmacological activities	Model used and study design	Extract type and dose	Observations	Ref.
Muscle relaxant effect	Guinea pigs/ Tracheal smooth muscle	Aqueous extract (2, 5 and 10 mg/mL) and theophylline anhydrous (0.25, 0.5 and 0.75 mM)	All concentrations of theophylline and the extract showed a relaxant effect in comparison with saline which was not significantly different from that of theophylline. A potent relaxant effect for the asafoetida extract on tracheal smooth muscle which is perhaps due to muscarinic receptor blockade.	Gholamnezhad et al., 2012
		Aqueous extract (2.5, 5 and 10 mg/mL), atropine (10 nM) and saline	The maximum responses to methacholine in the presence of 10 mg/mL concentration of the extract were significantly lower than that of saline. The values of CR-1, obtained in the presence of the extract, were significantly lower compared to atropine in the experimental group.	Khazdair et al., 2015
	Male Wistar rats	Aqueous extract (0.1, 0.2 and 0.3%)	Essential oil derived from *F. asafoetida* seed in concentrations of 0.2% and 0.3% significantly reduced Ach (10e4 M) induced contractions. Exposure of the 0.2% and 0.3% asafoetida reduced the percentage of maximum contraction induced by 10 e4 M Ach to 43% and 12%, respectively.	Bagheri et al., 2014a
	Precontracted tracheal chains of guinea pig by 60 mmol/L KCl and 10 mmol/L methacholine	Aqueous extract (2, 5 and 10 mg/mL), umbelliprenin (0.04, 0.2 and 0.4 mg/mL), theophylline (0.05, 0.1 and 0.15 mg/mL) and saline	The relaxant effect of the extract was significantly more potent than umbellipreni.	Bayrami et al., 2013
Neuroprotective effect	Rat brains and cerebellar granule neurons	80% methanol extract (100 mg/mL)	The extract displayed neuroprotective effects in glutamate-induced neurotoxicity. The extract exerted antiapoptotic activity in cerebellar granule neurons due to cell cycle arrest in G0G1 phase, which explains the beneficial effects of the extract as therapies for neurologic disorders.	Tayeboon et al., 2013
	Sciatic nerves of adult male Balb/c mice	Aqueous extract of oleo gum resin (0.1 mg/kg, 1 mg/kg and 10 mg/kg).	Aqueous extract of oleo gum resin of asafoetida increased the amplitude and decreased the latent period of nerve compound action potential. Nerve conduction velocity and amplitude of CAP also improved in asafoetida treated	Moghadam et al., 2014

			animals. Histological and behavioural studies showed that asafoetida was able to facilitate the healing process in peripheral nerves.	
Memory enhancing activity	Male inbred albino rats	Aqueous extract (200 and 400 mg/kg)	Significant improvement in memory score and dose-dependent improvement of transfer latency. Memory enhancing potential can be attributed to acetylcholinesterase inhibiting and antioxidant properties.	Vijayalakshmi et al., 2012
	Dementia induced by D-galactose and $NaNO_2$ in mice	Aqueous extract (100 mg/kg/d)	Asafoetida could prevent and treat amnesia may be due to the presence of biologically active compounds such as sesquiterpene coumarins and sulphur containing constituents.	Bagheri and Dashti, 2015
Digestive enzyme activity	Adult female Wistar rats	14 spices with 50 mg of asafoetida	Fenugreek, mustard, and asafoetida affected chymotrypsin and trypsin activities.	Platel and Srinivasan, 2000
			The positive influence of in vitro analysis on the activity of enzymes may have an additional role in the overall digestive stimulant action of spices to enhance the titers of digestive enzymes in pancreatic tissues.	Rao et al., 2003
Hypotensive activity	Sprague Dawley rats and guinea-pigs	Aqueous extract (0.3-2.2 mg/100 g)	*Ferula asafoetida* gum extract is effective in reducing blood pressure in anaesthetized normotensive rats. The extract also decreased contractions induced by acetylcholine, histamine and KCl in the isolated guineapig ileum.	Fatehi et al., 2004
Hepatoprotective effect	Carbon tetrachloride-induced liver toxicity in Wistar rats	A formulation of petroleum ether, chloroform, benzene, ethanol and aqueous extracts of *Ferula asafoetida, Momordica charantia* and *Nardostachys jatamansi*	Formulation (containing chloroform, petroleum ether and aqueous extracts of *Ferula asafetida*; petroleum ether and ethanol extracts of *Momordica charantia* and petroleum ether and ethanol extracts of *Nardostachys jatamansi*) shown significant hepatoprotective effect by reducing the elevated serum enzyme levels such as glutamate oxaloacetate transaminase, glutamate pyruvate transaminase and alkaline phosphatase.	Dandagi et al., 2008
Antimicrobial activity	Gram-negative (*Salmonella typhi* and *Escherichia coli*), Gram-positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis*), and fungi (*Aspergillus niger* and *Candida albicans*).	Essential oils obtained from *Ferula asafoetida* oleogum resins in different collection times	The essential oil obtained from the earlier stages of *F. asafoetida* growth could be used as safe and effective natural antioxidants in the food industry to improve the oxidative stability of fatty foods during storage. The essential oil obtained from the later stages could be used in the health industry as a safe and effective source of antimicrobial agents.	Kavoosi and Rowshan, 2013
	E. coli, *Pseudomonas aeruginosa*, *S. aureus*, *B. subtilis* and *A. niger*	Petroleum ether, acetone, carbon tetrachloride, methanol, ethanol and aqueous extracts	Alcoholic and aqueous extracts showed significant effect against *B. subtilis, S. aureus, E. coli, P. aeruginosa* and *A. niger*.	Shrivastava et al., 2012
	S. aureus,	Volatile oils of two	Pathani oil was found to be a good	Divya et al.,

	Yersinia enterocolitica, S. typhi, Bacillus cereus, B. subtilis, Listeria monocytogenes, E. coli and Salmonella paratyphi	varieties (Pathani and Irani)	antibacterial agent. Irani oil was found to be a good fungicidal agent.	2014
	Bacteria (*B. subtilis, S. aureus, Klebsiella pneumonia* and *E. coli*) and fungus (*A. niger* and *C. albicans*)	Chloroform, ethyl acetate, ethanol, methanol and aqueous extracts	Ethyl acetate, ethanol, and methanol extracts have significant antimicrobial and antifungal activity and highest activity was reported with the methanolic extract.	Patil et al., 2015
	E. coli, *K. pneumonia* and *Shigella flexneri*	Red and white forms of *Ferula asafoetida* extracts in hot water, hexane, ethanol and petroleum ether	Highest antibacterial activity was shown by hexane extract against *Shigella flexneri* and *S. aureus*.	Bhatnager, et al., 2015
	A. niger, C. albicans, C. blanki, C. cylindracea, C. glabrata, C. krusei, C. tropicalis and *Saccharomyces cerevisiae*	Essential oil	Asafoetida oil showed inhibitory activity toward all fungal strains, but activity was strong toward *C. tropicalis, C. albicans, S. cerevisiae,* and *A. niger*.	Kamble and Patil, 2008
	A. niger, A. flavus, Fusarium oxysporum, F. moniliforme, F. nivale, F. semitectum, Drechslera hawiinesis and *Alternaria alternate*	Essential oils extracted from the seeds	Asafoetida oil at 0.1% and 0.15% significantly inhibited the growth of all test fungi except *A. flavus* and *N. sativa*.	Sitara et al., 2008
	Sclerotium rolfsii, and *Macrophomina phaseolina*	A formulation containing neem oil, nicotinic acid and *Ferula asafoetida*	The formulation having *F. asafoetida* as the natural component showed significant antifungal activity.	Rani et al., 2009
	Trichoderma harzianum and *Pleurotus spp.*	Methanol extract of asafoetida oleo-gum-resin	Asafoetida showed fungicidal activity against *T. harzianum* and *Pleurotus spp.* at higher concentrations.	Angelini et al., 2009
	Bipolaris sorokiniana, Verticillium spp, Fusarium graminearum, Fusarium solani and *A. niger*	Seed essential oil	*B. sorokiniana* growth was completely inhibited by the essential oil.	Mostafa et al., 2013
Anti-quorum sensing activity	*Pseudomonas aeruginosa*	Essential oil (25 mg/mL)	Fully abolished the violacein production by *C. violaceum*. Pyocyanin, pyoverdine, elastase and biofilm production were decreased in Ferula oil treatments.	Sepahi et al., 2015
Antiprotozoal activity	*Blastocystis hominis*	Asafoetida (oleo-gum-resin) as powder and oil form	Asafoetida decreased counts and viability of all tested isolates of *B. hominis*. The degree of the inhibitory effect was dependent on the concentration and time of incubation.	El Deeb et al., 2012
Anticarcinogenic activity	Swiss albino mice	70% ethanol extract	Asafoetida extract inhibited two-stage chemical carcinogenesis	Unnikrishnan and

			induced by 7,12 dimethyl benzanthracene and croton oil on mice skin with a significant reduction in papilloma formation.	Kuttan, 1990
		Petroleum ether, benzene, ethyl acetate, acetone, methanol and aqueous extracts	The pretreatment of animals with asafoetida recovered the antioxidant level and reversed the induced ODC activity and DNA synthesis significantly.	Saleem et al., 2001
Anticancer activity	Sprague Dawley rats	Asafoetida (1.25 and 2.5% w/w in diet)	A significant decrease in tumour multiplicity after asafoetida treatment. A striking reduction in the number of terminal end buds during mammary gland differentiation.	Mallikarjuna et al., 2003
		Asafoetida orally daily (10 and 20 mg/100 g BW)	Asafoetida supplementation attenuates DMH induced deleterious effects in of rats. Medium dose of 10 mg/100 g BW exhibited more pronounced effect as it constantly influenced all the tested biochemical parameters.	Panwar et al., 2015
	Oncogenic ras-transformed NIH3T3/Hras-F cells	Galbanic acid	Galbanic acid demonstrated potent inhibition of the proliferation of oncogenic ras-transformed NIH3T3/ Hras-F in a dose-dependent manner	Cha et al., 2011
Antihyperglycemi c effect	Male Wistar rats	Aqueous extract of oleo gum resin (50 mg/kg)	The blood glucose level in streptozotocin-induced diabetic animals was reduced	Akhlaghi et al., 2012
Protein and metabolic activity	Male Wistar albino rats	*Nigella sativa* (50-400 mg/kg), *Trigonella foenumgraecum* (25-600) and *Ferula asafoetida* (50-450)	Asafoetida significantly inhibited the mRNA and protein expression levels of CYP2C11 in a dose-dependent manner. The in vitro enzyme metabolic activity study showed a significant decrease in the formation of 4-hyroxytolbutamide, a tolbutamide metabolite, at the higher doses.	Korashy et al., 2015
Cytotoxicity activity	Male NMRI mice	Oleo-gum-resin (300 mg/kg)	Oleo-gum-resin exhibited a cytotoxic effect with LC_{50} values in the range of 6-321 mg/mL.	Bagheri et al., 2010
Anti-obesity and fat lowering effect	Male Wistar rats	Oleo-gum-resin(25 or 50 mg/kg)	Administration of *Ferula asafoetida* significantly decreased body weights, abdominal fat and size of epididymal adipocyte compared to untreated rats. Levels of serum leptin were significantly decreased in treated rats.	Azizian et al., 2012
Anxiolytic effect	Swiss albino mice and Wistar albino rats	Asafoetida orally daily (0.1, 0.3, 1, 1.5 and 2 g/kg)	A dose-dependent anxiolytic and analgesic activity of asafoetida, with a mild sedative effect in high doses. Compared to diazepam, the asafoetida seems to be a better alternative for the treatment of anxiety disorders.	Alqasoumi, 2012
Anthelmintic activity	Pheretima postuma-adult Indian earthworms	Aqueous extract from Ferula asafoetida (25, 50, 100 mg/mL)	The extract has exhibited significant anti-helmintic activity at the highest concentration of 100 mg/mL.	Gundamaraj u, 2013
Anthelmintic activity	*Fasciola gigantic*	Acetone, ether, chloroform and ethanol extracts (2-10 mg/mL)	The ethanol extract (2 h; LC_{50} 3.94 mg/mL) was toxic against *Fasciola gigantic*.	Kumar and Singh, 2014
Spermatogenic activity	Male Wistar rats	Asafoetida orally daily (25, 50, 100 and 200 mg/kg)	Asafoetida significantly increased the number and viability of sperms. Spermatogenesis process and numbers of Leydig cells were increased with increasing the dose.	Bagheri et al., 2015

Antispasmodic action

Fatehi et al. (2004) demonstrated that *F. asafoetida* gum extract was helpful in reducing blood pressure in anaesthetized normotensive rats. This effect of gum extract on the contractile responses of the isolated guinea-pig ileum stimulated by histamine, acetylcholine, and KCl; therefore mean arterial blood pressure in the rat was investigated. There was a decrease in average amplitude of contractions of the isolated guinea-pig ileum was observed when opposed to control. The exposure of precontracted ileum treated with acetylcholine to *F. asafoetida* gum extracts caused relaxation in a dose-dependent manner. The gum extracts appreciably reduced the mean arterial blood pressure in anaesthetized rats. It has also been noted that *F. asafoetida* gum extract possesses some good relaxant compounds which interfere with a range of histamine, muscarinic receptor and adrenergic activities, or the movement of calcium ions across membrane required for smooth muscle contraction non-specifically (Rollinger et al., 2008).

Antiulcer action

Alqasoumi et al.evaluated the antiulcer activity of aqueous suspension from *Asafoetida* prepared in 1% carboxymethyl cellulose in the water on various ulcer induced models of Wistar albino rats. Gastric ulceration was induced by pylorus ligation in rats comparing with indomethacin used as standard and induction of gastric lesions by narcotizing agents such as by 80% ethanol, 0.2 M NaOH and by 25% NaCl. After administration of suspension, there was significant protection in all models. They reported that gastric ulceration induced by indomethacin, basal gastric acid secretion, and noxious chemicals was significantly improved with the suspension at doses of 250 and 500 mg/kg body weight, orally (but i.p. in Shay rat model). The aforesaid observations were supported by a histopathological assessment of gastric tissue and by determination of gastric wall mucus (GWM) contents of the stomach as these parameters exhibited enhanced protection of various indices and by replenishing the depleted GWM level by suspension treatment. Authors discussed it is not well known that which chemical constituents of asafoetida are accountable for gastroprotective activity. However, previous researches reported that this plant contains resinous material that consists of ferulic acid, other flavonoid glycosides and coumarins. Ferulic acid is known to exert antioxidant activity by reducing vascular disorders in humans by strengthening the membranes It is well recognized that antioxidants play a significant role in preventing gastric mucosal damage by strong cell defence mechanisms, likely to stimulate the endogenous synthesis of prostaglandins or by a protective role as a membrane stabilizing agent and act by scavenging oxygen free radicals. Further, authors discussed that anticholinergic drugs show inhibition of acid secretion and slow gastric motility and possibly this might be the one of the mechanism(s) by which the suspension of asafoetida offers its antiulcer effect (Alqasoumi et al., 2011; Adiga et al., 2012).

Hepatoprotective action

Dandagi et al. (2008) reported the hepato-protective activity of different extracts such as those of *F. asafoetida, Momordica charantia,* and *Nardostachys jatamansi* against experimentally induced hepatotoxicity. The extracts of benzene, chloroform, petroleum ether (60-80), ethanol, and aqueous of *F. asafoetida*, *M. charantia* Linn, and *N. jatamansi* were evaluated against carbon tetrachloride-induced liver toxicity in Wistar rats for their respective hepatoprotective activities. Polyhedral suspensions of the above-mentioned extracts were prepared and then respective hepatoprotective activities were screened by determining the levels of serum enzymes such as 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 the polyhedral suspension of the extracts exhibited promising activity against the carbon tetrachloride-induced hepatotoxicity (Dandagi et al., 2008).

Digestive enzyme activity

In general, the spices have strengthened salivary flow and gastric juice secretion and support in the digestion process, due to enzymatic participation in digestion. Some common spices or active principles were evaluated for their probable influence on digestive enzymes of the pancreas in experimental rats. The animal groups were kept for 8 weeks on the following the spice diets are 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). Among these spices, *Asafoetida* significantly enhanced pancreatic lipase activity and also stimulated pancreatic amylase. The positive impact of the pancreatic digestive enzymes exerted by a good number of spices consumed in the diet could be a factor contributing to the well-recognized digestive stimulant action of spices. Rao *et al*. also examined the *in vitro* influence of 14 spices along with *Asafoetida* on the effects of digestive enzymes of rat pancreas and small intestine including them in the reaction blend of two dissimilar concentrations. A majority of spices improved the activity of pancreatic lipase and amylase when they

are directly influencing the enzyme (Rao et al., 2003).

Anxiolytic effect and anthelmintic activity

Alqasoumi (2012) discussed the analgesic, sedative and anxiolytic activities of *Asafoetida* in rodents, using hot plate, motor activity meter, and elevated plus maze. Diazepam was used as a standard anxiolytic agent. The results have shown a dose-dependent anxiolytic and analgesic activity of *Asafoetida* with a calm sedative result in high doses. The *Asafoetida* seems to be a better option for the cure for anxiety disorders. Low doses of *Asafoetida* can be a therapeutic alternative to the presently used anxiolytic drugs (Azizian et al., 2012).

Gundamaraju (2013) evaluated the anthelmintic activity of three different concentrations of aqueous extract of *F. asafetida* against *Pheretima posthuma* that involved the determination of time of paralysis and death of the worm. The extract has shown significant anthelmintic activity at the highest concentration of 100 mg/mL. It has also shown better expressive activity than the standard drug of piperazine citrate. Kumar and Singh (2014) studied the effect of dried *Allium sativum* clove powder. *F. asafoetida* dried latex powder and flower but dried powder of *Syzygium aromaticum* in the management of liver fluke *Fasciola gigantica*. All the three plants were evaluated for anthelmintic activities at the same time-concentration and time-dependent. The ethanol extract was more toxic than other organic extracts. Ethanol extract of *F. asafoetida* was highly toxic against *F. gigantic*. The dried root latex powder of *F. asafoetida* can be invoked as a potent helminthicide.

Antinociceptive effect

The analgesic activity of asafoetida (25, 50 and 100 mg/kg) was compared with that of sodium diclofenac (30 mg/kg) or morphine sulfate (8 mg/kg) by using a hot plate and acetic acid-induced writhing tests. The authors found that asafoetida reduced the number of acetic acid-induced writhes in an inverse dose-dependent manner [lower (25 mg/kg) and moderate (50 mg/kg) doses] produced an analgesic effect comparable to that of the sodium diclofenac. A considerable effect of the asafoetida at all doses were found 15 min after treatment in the hot plate test and in general analgesic pattern of the most effective dose (50 mg/kg) was very comparable to morphine sulfate. They assumed that the analgesic effect of asafoetida was because of its action to the inhibit production/action of prostaglandins or to its action on visceral receptors sensitive to acetic acid. Hence, the analgesic effect of asafoetida in the hot plate test may be correlated to the opioid pain inhibitory pathways (Bagheri et al., 2014b). Further, the authors discussed that the antinociceptive activity of asafoetida may be due to the phenolic compounds such as ferulic acid which are present in high content in asafoetida (Dehpour et al., 2009). One probable mechanism of action for the active principles of this oleo-gum-resin could be linked to lipooxygenase and/or cyclooxygenase in the arachidonic acid flow at the peripheral route. Umbelliprenin of asafoetida can inhibit the activity of 5-lipooxygenase and shows the anti-inflammatory action (Iranshahi et al., 2009) as it has been established that sesquiterpene coumarins are the most bioactive components of asafoetida (Iranshahi, 2011) and umbelliprenin is one of the sesquiterpene coumarins. The authors concluded that asafoetida exhibited a significant anti-nociceptive effect on chronic and acute pain in mice which most likely involves central opioid pathways and peripheral anti-inflammatory action (Dehpour et al., 2009).

Anti-microbial effect

Aqueous and alcoholic extracts of asafoetida have shown anti-microbial activity e against various bacterial and fungal strains like *C. albicians, E. coli, S. aureus, B. subtilis, P. aeruginosa,* and *P. chrysogenum* by agar well diffusion method (Kareparamban et al., 2012).

DISCUSSION

Abdominal pain may be the consequence of one or more causes out of several, which include indigestion, ulceration, spasm, microbe infestation, anxiety, improper liver metabolism etc. besides many surgical conditions. From Ayurvedic point of view abdominal pain i.e. *Kukshishool* is mainly because of *Aam* (which is the main consequence of *Mandagni*) & *Vaat* (Shastri, 2000, 42/125). *Deepan (*inducing *Agni)* & *Pachan* are mentioned in the line of treatment along with Vaman & Langhan (Shastri, 2000, 42/126). The prime dosha in any type of *shool* is Vaat, that is why the required balancing of vata dosha is mentioned at first (Shastri, 2000, 42/88).

Hingu has actions like an aphrodisiac, antispasmodic, anthelminthic, carminative, diuretic, emmenagogue, expectorant, mild laxative and nervine tonic. It is used in croup, asthma, bronchitis; colic pain, flatulence, and spasmodic movement of the bowels and infantile convulsions being an important ingredient in compounding medicinal preparations prescribed in habitual abortion, liver troubles, indigestion, diarrhoea, flatulence; applied externally to ringworm (Anonymous, 1997, 2002; Khare, 2007;).

As per Ayurvedic view, *Hingu* has *Katu rasa, Laghu, Snigdha* and *Teekshna guna, Ushna veerya* and *Katu vipak*. In *Charak Samhita* it has been mentioned under *Deepaniya, Swashara & Sangyasthapan mahakashay. Hingu* is used to pacify *vata* and *kapha dosha*, it increases *pitta dosha* and

used to relieve abdominal pain (Sharma and Dash, 2001; Shastri, 2000, 46/228).

Thus due to its hepatoprotective and digestive enzyme activity, *Hingu* has the potency to subside the abdominal pain due to physiological/ metabolic disturbances, on the other hand by virtue of its antiulcer, antimicrobial and antispasmodic action, it also relieves abdominal pain due to anatomical/ pathological wear and tear. It's antinociceptive action manage the pain at a tertiary level too. Sufficient explanations can be drawn with Ayurvedic view as its Ayurvedic properties are against the etiopathogenesis (*nidan* & *samprapti*) and as per the *chikitsa sutra* (line of treatment) of *shool* i.e. abdominal pain.

CONCLUSION

From the vivid overview and discussion, we conclude that *Hingu* (the oleo gum resin) has the sufficient potency to encounter most of the mechanisms responsible for abdominal pain and it can be very useful for the management of almost all types of abdominal pain excluding those cases where surgical interventions are needed.

CONFLICT OF INTEREST

Authors declare no conflicts of interest.

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