Anisoon (*Pimpinella anisum* L.): A review of Pharmacological Activities and Clinical Effects

Khadija Zahid Ali, Azhar Hasan, Shabir Ahmad Parray, Wasim Ahmad

Mohammadia Tibbia College, Mansoora, Malegaon, Nashik- 423203, India.

Abstract

Unani drug Anisoon, the seeds of a plant *Pimpinella anisum* Linn, is one of the oldest spices and important medicinal herb mentioned by Greek and Roman Unani physicians in their treatises for its diverse therapeutic properties centuries ago. It is one of the most ancient crops cultivated in the eastern Mediterranean Region, Western Asia, the Middle East, Mexico, Egypt, and Spain. In Unani system of medicine, it is used as Kasir-e-riyah, Mohallil-e-Riyah, Muqawwi-e-Meda, Mushtahi, Mufatteh, Mufatteh Sudad, Munaffis-e-Balgham, Mukhrij-e-Balgham, Muddir-e-Bol, while in ethno-medical literature it has been described to be mild expectorant, stimulant, carminative, diuretic, and diaphoretic showing that the plant has diverse biological and pharmacological activities. Keeping in view its high medicinal importance in Unani medicine, a comprehensive review based on Unani, ethnobotanical, phytochemical and pharmacological literature has been presented with an aim to expose new frontiers for research and therapeutic application of anisoon.

Keywords: *Pimpinella anisum*, Anisoon, Unani Medicine, Mudir-e-Bol, Mufatteh Sudad, Kasir-e-riyah

Introduction

Medicinal plants have played an important role in the treatment of diseases all over the world. Unani system of medicine (USM) is a rich source of medicinal herbs, used from centauries (Parray *et al*., 2012). The versatility and richness of USM is due to interaction of various pathies, where Unani physicians and scholars have not only included the drugs from other traditional medicines but have undertaken experimental works to prepare the profile for their medicinal effects and therapeutic uses (Mobeen *et al*., 2017). Anisoon (*Pimpinella anisum* Linn) is one such herb used from centauries in USM for different pharmacological effect.

It is one of the oldest spices and an important medicinal herb (Shobha, 2013). Greek and Roman physicians have mentioned its therapeutic uses in their treatises centuries ago. Theophrastus, Dioscorides and Pliny have described its use in their books 2000 years ago (Evans, 2002) and its medicinal activities have been described in Unani, Ayurveda, British Pharmacopoea and WHO monograph which is mainly attributed to its essential oil (Jamshidzadeh, *et al*, 2015). Anisoon is primarily grown for its fruits that are harvested in August and September. It belongs to the Umbelliferae family.

* Author for correspondence

Habitat

Aniseed is indigenous to Egypt, Greece and Western Asia. It is cultivated in Eastern Mediterranean region, Middle East (Shojaii *et al*, 2012), Russia, France, Spain, Italy, Bulgaria, Mexico, India (Kokate *et al*, 2007), North Africa, Central Europe (Anonymous, 2005), Southern Europe, Turkey, Central Asia, China, Japan, Central and South America (Anonymous, 2000). In India it is cultivated in Madhya Pradesh (Khare, 2004), Uttar Pradesh, Punjab and Orissa (Kokate *et al*, 2007). Spain and Egypt are the principal producers of its oil (Evans, 2002). A large quantity of aniseed is said to be exported from India and also imported, exports are mainly made to Afghanistan and Pakistan and imports are mainly from Malaysia, Vietnam and Taiwan (Anonymous, 2005).

Cultivation

Pimpinella anisum is primarily grown for its seeds (aniseeds). It is harvested in August and September. The plant prefers a light, fertile or moderately rich, well-drained sandy loam and is propagated by seeds. Plant is cultivated from middle of October to the end of November in plain areas, and from the beginning of April to the end of May in hilly areas. About 13 kg of seeds are sufficient to plant a hectare of land. The crop is ready for harvesting in 3.5 months after planting when the tips of the seeds turn greyish green. Under favourable conditions, a yield of 445-665 kg of fruit per hectare may be expected (Anonymous, 2005).

Botanical Name: *Pimpinella anisum* (Nadkarni, 2007; Khare, 2004; Tariq, 2010)

Family: Umbelliferae, Apiaceae, (Anonymous, 2005; Nadkarni, 2007)

Vernaculars

Arabic: Anisun (Nadkarni, 2007) Bazrul Razyanaj Roomi (Ramlubhaya, 2004; Ibn Baitar, YNM, Anonymous, 2007), Razyanje Shami, Habul Hulu, Kamoon Hulu (Noor Karim, YNM; Ibn Baitar, YNM; Anonymous, 2007), Persian: Badian (Nadkarni, 2007), Badiyan Roomi, Zeera Roomi (Kareem, YNM; Ghani, 2011; Ibn Baitar, YNM; Anonymous, 2007), Unani: Anisoon, Badiyaan-roomi (Khare, 2004; Kabiruddin, YNM; Anonymous, 2007), Aanis, Omariqa (Ibn Baitar, YNM). English: Anise, Aniseeds, Spanish Aniseeds (Khare, 2004), Sweet Fennel (Nadkarni, 2007), Aniseed (Ibn Baitar, YNM), Anisi (Tariq, 2010), France: Anis. (Nadkarni, 2007), German: Anis-Biberrell (Nadkarni, 2007), Hindi: Saunf, Sawolf, Badian (Prajapati *et al*, 2003), Saurif (Nadkarni, 2007), Sanskrit: Shatapushpa, Madhurimisi, Karavee, Shatava, Shetpushpa (Nadkarni, 2007), Nepal: Sop (Anonymous, 2005), Bengali: Muhuri, Mitha jira (Prajapati *et al*, 2003), Mori (Kabiruddin, YNM; Tariq, 2010), Gujrati: Anisa (Prajapati *et al*, 2003), Kannad: Shomba (Prajapati *et al*, 2003), Marathi: Somp, badishep (Anonymous, 2005; Anonymous, 2007), Oriya: Sop (Anonymous, 2005), Sindhi: Saunf Roomi

(Kabiruddin, YNM; Tariq, 2010), Tamil: Shomba (Prajapati *et al*, 2003), Telgu: Kuppi,sopu (Prajapati *et al*, 2003; Anonymous, 2007),

Botanical Description

Macroscopic characteristics

The fruit (schizocarp or cremocarp) ovoid or pyriform, laterally compressed, 3-5 mm in length and 2-3 mm broad, grayish green to grayish brown, mericarp broadly ovoid, 5-ridged with short hairs and numerous vittae (Anonymous, 2005). The seed have a sweet taste and a characteristic odour and aromatic; the aroma is more when crushed. Seeds are rough to touch; primary ridges are slender, pale and uniform in width short bifurcate stylopod at the apex (Kokate *et al*, 2007). The flowers are small, white, in compound umbles (Anonymous, 2005). The inflorescences are medium sized umbels with about 7 to 15 scattered pubescent rays. There is usually no involucre, but sometimes there is a single bract. There are barely any sepals. The petals are white, about 15 mm long, and have a ciliate margin. They have small bristles on the outside and a long indented tip (Anonymous, 2000). The root is thin and fusiform, and the stem is erect, round, grooved and branched above (Anonymous, 2000). The leaves are pinnatifid or terminately pinnate (Anonymous, 2005; Anonymous, 2007). The lower leaves are petiolate, orbicular-reniform, entire and coarsely dentate to lobed. The middle leaves are orbicular and 3-lobed, or 3-segmented with ovate or obovate segments. The upper leaves are short petioled to sessile with narrow sheaths; they are pinnatisect with narrow tips (Anonymous, 2000).

Microscopic Study of Seed

Under the microscope, transverse section of anise show an epidermal layer bears numerous papillae and unicellular hairs (Evans, 2002). The epidermis of fruits is covered by numerous, unicellular conical thick walled warty trichomes (Kokate *et al*., 2007). On the dorsal surface of each mericarp are from 15-45 branched vittae (Evans, 2002), while two large vittae are seen on commissural surface (Kokate *et al*., 2007). An endosperm is slightly concave on the commissural surface and contains protein and fixed oil (Evans, 2002), small aleurone grains, rosette crystals of calcium oxalate (Kokate *et al*., 2007).

Powder Study of Seed

Powder analysis of crude drug revealed the presence of fragments of epicarp, mesocarp, vittae, endosperms, trichomes, vessels and seclereids (Anonymous, 2007).

Identification and Purity

The TLC behaviour of the petroleum ether reveals the two peak spots which possessed R_f values of 0.11 and 0.87, respectively (Anonymous, 2007).

The different parameters for the standard purity tests were done and the results are given in table 1.

Table 1: Identification and purity parameters of Anisoon

Name of Parameter	Value of the Test
Foreign Matter	Not more than 2%
Total Ash Value	Not more than 17%
Acid Insoluble Ash	Not more than 7%
Alcohol soluble extractives	Not less than 1.5%
Water soluble extractives	Not less than 16%

Parts Used

The medicinal parts are fruit of anise (Aniseeds) and the essential oil from the ripe fruit and dried fruit (Evans, 2002; Anonymous, 2000). In USM, seeds of Anisoon are used (*Tukhme Anisoon*) medicinally.

Mizaj (Temperament)

Unani physicians described the *Mizaj* (temperament) of Anisoon (*Pimpinella anisum*) as:

- Hot 2nd degree and Dry 3rd degree (Ghani, 2011; Kareem, YNM),
- Hot and Dry 2nd degree (Ghani, 2011; Kareem, YNM; Kabiruddin, YNM),
- Hot and Dry 3rd degree (Ibn Baitar, YNM; Ghani, 2011; Baghdadi, 2005; Anonymous, 2007).

Miqdare Khorak (Dose)

Seeds: 2 to 5 gm (Tariq, 2010; Kabiruddin, YNM; Anonymous, 2007), 7 to 10 gm (Hakim, 1999).

Oil: 2 to 3 drops (Tariq, 2010; Ali 1993).

Mazarrat (Side effects)

Anisoon has been described to produce adverse effects on intestines (Kareem, YNM), urinary bladder, stomach and lungs (Ghani, 2011; Kabiruddin, YNM; Tariq, 2010).

Musleh (Corrective)

Sikanjabeen and *Saunf* (*Illicium verum*) are used as *musleh* (Ghani, 2011; Kareem, YNM; Kabiruddin, YNM; Tariq, 2010).

Murakkabat (Compound Formulations of Anisoon)

Arq-e-Badiyan (Anonymous, 2005), Sharbat-e-Farasiun, Qurs-e-Rewand, Jawarish-e-Jalali, Jawarish-e-Kholikhan, Jawarish-e-Khozi, Jawarish-e-Qurtum,

Safoof Namak Shaikhur-Raees, Safoof Namak Sulemani, Dawa-e-Ajeeb (Ramlubhaya, 2004), Jawarish-e-Ood Shireen, Habb-e-shab-e-yar (Anonymous, 2007; Ali 1993). Jawarish-e-Narmushuk, Jawarish-e-Shaheryaran, Itrifal-e-Ghuddadi, Hab-e-Iyarij, Majoon-e-Antaki, Majoon-e-Jalinoos Lului, Sufoof-e-Moya (Anonymous, 2007)

Afa'al (Action)

Following different pharmacological actions of anisoon (*Pimpinella anisum*) have been described in the literature:

Kasir-e-Riyah (Carminativae) (Ibn Baitar, YNM; Anonymous, 2007), Mohallil-e-Riyah (Antiflatulant) (Ghani, 2011; Hakim, 1999; Anonymous, 2007), Muqawwi-e-Meda wa Fam-e-Meda: (Stomach Tonic) (Kareem, YNM), Habis-e-Shikam (Astringent) (Ibn Baitar, YNM), Mushtahi (Appetizer) (Tariq, 2010) Mushil (Purgative) (Ibn Baitar, YNM; Ghani, 2011), Mufatteh (Deobsruent) (Kabiruddin, YNM; Ahmad, 2010), Mufatteh Sudad (Deobsruent) (Anonymous, 2007), Musakkin-e-Auja (Analgesic) (Hakim, 1999; Baghdadi, 2005; Kareem, YNM; Ibn Baitar, YNM; Ghani, 2011), Munaffis-e-Balgham (Expectorant) (Kabiruddin, YNM), Mukhrij-e-Balgham, Muddir-e-Bol (Diuretic) Ghani, 2011; Anonymous, 2007), Muddir-e-Haiz: (Emmenogauge) (Ghani, 2011; Baghdadi, 2005; Anonymous, 2007), Muddir-e-Sheer (Galactogauge) (Hakim, 1999; Baghdadi, 2005) Jali (Detergent) (Kareem, YNM) Musakkhin (Calorific) (Ramlubhaya, 2004) Mulattif (Demulcent) (Ghani, 2011; Hakim, 1999), Mohallil-e-Warm (Anti-inflammatory) (Ghani, 2011; Ibn Baitar, YNM;), Mohallil (Resolvent) (Baghdadi, 2005), Muarriq (Diaphoretic) (Ibn Baitar, YNM), Muhassin-e-Lone (skin fairer) (Ghani, 2011), Muqawwi-e-Bah (Aphrodisiac) (Ibn Baitar, YNM), Muqawwi-e-Gurda (Renal Tonic) (Ghani, 2011), Mufattit-e-Hisat (Lithotriptic) (Kareem, YNM), Musqite Janeen wa Mashima (Abortificient) (Ghani, 2011), Dafa-e-Tashannuj (Anticonvulsant) (Ghani, 2011; Anonymous, 2007), Qatile Qumal (Lice killer) (Kareem, YNM).

Istemalat (Uses)

Anisoon (*Pimpinella anisum*) has been described to be useful in various diseases such as *Sailanur Rahem* (discharges from the uterus) (Ghani, 2011; Baghdadi, 2005; Ibn Baitar, YNM) in both decoction and *Humool* (tampon) form (Jeelani, 2005; Razi, 2001). It acts as *mufatteh-sudad* (Deobsruent) (Anonymous, 2007). Its decoction is useful in *sudad-e-jigar wa tihal* (Ibn Baitar, YNM), *wa masana wa rahem* (Ramlubhaya, 2004). Its fumigation helps in expulsion of foetus (Hakim, 1999) and relieves *suda-e-barid* (Baghdadi, 2005). It is beneficial in *istasqa* (Ascites) (Ibn Baitar, YNM; Kareem, YNM). *Biryan* (roasted) anisoon is used in *bawasir* (Piles) (Hakim, 1999); its powder is especially effective in *bawasir-e-rehi* (Ghani, 2011).

Anisoon clears facial complexion (Hakim, 1999) and increases milk secretion (Ibn Baitar, YNM). Its oral form is used in *idrar-e-haiz* and *qillat-e-sheer* (Ramlubhaya, 2004). It resolves *riyah* (flatulance) and relieves intestinal colic (Hakim, 1999). Due to its *kasir-e-riyah* property, it is used in *dard-e-shikam* (Abdominal pain) and *dard-e-gurda rehi*. Being a *musakhkhin* it increases body temperature. Because of its *munaffis-e-balgham* property, it expels out *balgham* (Expectorant) in patients of *dama* (asthma) and *suaal* (cough). Being *jali* (detergent), anisoon cleanes *akhlat-e-lazija wa ghaliza* from *meda wa rahem* (Ramlubhaya, 2004).

Powdered anisoon 1.5 gm, mastagi (*Pistacia lentiscus*) 4 ratti (500 mg) mixed with *arq-e-qaranfal* (*Myrtus caryophyllus Spreng*) and *gulqand* (Rose petal jam) 3 tola (30 gm) is used in *qabz* (constipation) (Ramlubhaya, 2004). Its *bakhoor* and *saoot* is effective in *dare-d-sar barid* (cold headache), *shaqiqa* (migraine), *duwar* (vertigo), *barid nazla* (common cold), *falij* (Paralysis), *laqwa* (facial palsy) *wa istarkha* and otalgia (Hakim, 1999). Its fine powder mixed with *roghan-e-gul* (rose oil) is useful in otalgia (Ghani, 2011). *Zimad* of anisoon is beneficial in *istarkha* (Hakim, 1999). Its *surma* is efficacious in eye diseases (Ghani, 2011; Ibn Baitar, YNM).

Its *manjan* (tooth powder) is useful in foul smelling of mouth and cleaning of teeth (Ibn Baitar, YNM). Chewing of anisoon seeds is very effective in *suda-e-barid*, *shaqiqa, dard-e-seena* (chest pain), *khansi* (cough), *dama* (asthma), *khafqan* (palpitation). Its powder in *roghan-e-gul* (rose oil) is useful in *shagaf-e-androoni uzn* (tear in internal ear) due to trauma (Ibn Baitar, YNM). Its decoction with *aslus-soos* (*Glycyrrhiza glabra* Linn) is beneficial in *dama* (asthma) and chest diseases (Ibn Baitar, YNM), *shaqiqa, khafqan, sardi, khansi, darde sar barid* and beneficial for lungs (Ghani, 2011). It is effective in *laisar-e-ghus* and *sabat-e-balghami* because it changes temperament of brain and acts as a *muqawi-e-maida* (Ghani, 2011). *Joshanda* of 7 gm anisoon in water mixed with *gulqand-e-asli* 3 *tola* (30 gm) is effective in *sabaat* (coma), which is caused by *kharij sardi* or consumption of *advia-e-mukhaddira* (sedatives) (Ghani, 2011).

Powder of anisoon mixed with *gulqand* (ose petal jam) cures *malenkholia* (schizophrenia), especially in *malenkholia miraqi. Joshanda* of anisoon with *shahed* (honey) is beneficial in *qaboos* (nightmare) and *falij*. Joshanda of anisoon with sugar used to dissolve yellowness of cheeks of mother after delivery. Chewing of anisoon is carminative; it acts as *muqawwi-e-fam-e-maida,* and expel out its *ratoobat*. It has diuretic action and is effective in renal calculi. It is effective in *tape balghami kohna* (chronic phlegmatic fever) (Ghani, 2011) and useful in chronic fevers (Ibn Baitar, YNM). It is used as a *muqawwi-e-bah wa muqawwi-e-gurda* (Ghani, 2011).

It acts as an antidote in insect bite poisoning (Ibn Baitar, YNM) and acts as an antidote of some poisons (Ghani, 2011). *Roghan-e-anisoon* is *daf-e-tashannuj*

(anticonvulsant) (Ghani, 2011; Tariq, 2010). Anisoon is used to lessen the intestinal colic one of the common side effects of *advia-e-mushila* (laxative) (Ghani, 2011; Kareem, YNM).

Therapeutic uses as described in Ethno-medicine

The local application of oil of anisoon is useful in headache, flatulence and intestinal colic (Khare, 2004; Nadkarni, 2007). Its root is used in fever (Khare, 2004; Anonymous, 2005). It is used in liver diseases on account of having hepatotonic effect (Khare, 2004; Anonymous, 2000). It is also used in gall bladder complaints (Khare, 2004), common cold, cough, bronchitis (Anonymous, 2000), bronchial catarrh (Nadkarni, 2007) and whooping cough (Anonymous, 2000). Anise oil is used externally to treat lice and scabies (Prajapati *et al*, 2003; Khare, 2004).

It is used as aroma in toilet soaps and dentifrices (Khare, 2004). Anise leaves are used for garnishing and flavouring purposes (Nadkarni, 2007). Seed pods are used as a remedy for dyspepsia, relieve flatulence, indigestion, colic in children and to diminish the griping of purgatives (Nadkarni, 2007; Anonymous, 2000). Anisoon used as an insect repellent (Anonymous, 2000). It is used in inflammation of mouth and pharynx (Anonymous, 2000), menstrual disturbances and tuberculosis (Anonymous, 2000) and also as an antiseptic (Anonymous, 2005).

In homeopathic medicine it is used for shoulder pain and lumbago (Anonymous, 2000). Its oil used externally as an insecticide against small insects such as head lice, mites and vermin (Anonymous, 2005). Oil of anise is used in perfumery, soaps and other toilet articles and for flavouring culinary preparations, confectionery, beverages and liqueur anisette. It is used in perfuming sachets, dental preparations and mouth washes, it is also used in the manufacture of lacquers. It is used as an ingredient of cough lozenges in combination with liquorice, also in the treatment of cholera to prepare gripe water. It has also fungicidal properties (Anonymous, 2005).

Phytochemistry

Anise contains 1.5 to 3.5% volatile oil, 10% fixed oil, proteins, mucilage, and starch. The volatile oil of Anisoon on steam distillation, has a characteristic odour and taste; colourless or pale yellow in colour (Kokate *et al*., 2007; Anonymous, 2005). The major compounds of the essential oil of anise seeds are trans-anethole, methylchavicol, anisaldehyde, estragole, (Nadkarni, 2007; Anonymous, 2000) cumarins, scopoletin, umbelliferone, estrols, terpenehydrocarbons, polyenes, and polyacetylenes (Gulcin *et al*., 2003). The essential oil of *Pimpinella anisum* L. fruits showed the presence of trans-anethole (93.9%) and estragole (2.4%). Other compounds that were found with concentration higher than 0.06% were

(E)-methyleugenol, α-cuparene, α-himachalene, β-bisabolene, p-anisaldehyde, and cis-anethole (Ozcan *et al*., 2006).

The composition of essential oil of *Pimpinella anisum* L. fruits obtained from different geographical areas of Europe, showed the presence of trans-anethole (76.9–93.7%) and γ-himachalene (0.4–8.2%), trans-pseudoisoeugenyl 2-methylbutyrate, p-anisaldehyde, and methylchavicol (Orav *et al*., 2008). The other phytochemical studies revealed that the plant and the seeds of *Pimpinella anisum* from Alberta showed trans-anethole 57.4% of whole plant and 75.2% of seed oil, respectively (Embong *et al*., 1997).

The major compounds obtained by supercritical extraction using CO_2, were anethole (90%), γ-himachalene (2−4%), p-anisaldehyde (<1%), methylchavicol (0.9−1.5%), cis-pseudoisoeugenyl 2-methylbutyrate (3%), and trans-pseudoisoeugenyl 2-methylbutyrate (1.3%) (Rodrigues *et al*., 2003). Volatile oil of anise contains specific gravity 0.978-0.988, optical rotation +1 to -2, refractive index 1.553-1.560 (Kokate *et al*., 2007).

A new terpene hydrocarbon called neophytadiene was isolated from aniseed in 1978 (Burkhardt *et al*., 1986); phenolic glycoside, 4-(β-d-glucopyranosyloxy) benzoic acid, was also isolated from aniseeds (Driks *et al*., 1984). Four new aromatic compounds were isolated from the polar portion of methanolic extract of anise fruits (Fujimatu *et al*., 2003). Quercetin 3-glucuronide, rutin, luteolin 7-glucoside, isoorientin, and isovitexin as crystalline compounds, apigenin 7-glucoside, and a luteolin glycoside as noncrystalline compounds from anise have also been isolated (Kunzemann *et al*., 1977).

The fatty acids composition of aniseed oil on silver ion HPLC showed isomeric 18:1 fatty acids oleic acid (cis 9–18:1), petroselinic acid (cis 6–18:1), and cis-vaccenic acid (cis11–18:1), respectively (Denev *et al*., 2011). Also three lignin-carbohydrate protein complexes were isolated from a hot water extract of its seeds by column chromatography (Lee *et al*., 2011).

Pharmacological studies

A number of studies have been carried out on *Pimpinella anisum* Linn in recent years showing that it possesses diverse pharmacological effects. Some of the important pharmacological studies conducted so far are briefly described below:

Antimicrobial activity

The antibacterial activities of different extracts of *Pimpinella anisum* L were studied by a number of research scholars (Akhtar *et al*., 2008; Gulcin *et al*. 2003; Ates *et al*., 2003; Chaudhry *et al*., 2006). Synergic antibacterial activity between *Thymus vulgaris* and *Pimpinella anisum* has also been reported (Al-Bayati, 2008).

Antifungal activity

The essential oil of aniseed showed significant inhibitory activity against fungi (Kosalek *et al*., 2005; Ozcan *et al*., 2006; Yazdani *et al*., 2009), and anethol was found to be the most active component (Shukla *et al*., 1987).

Analgesic and Anti-Inflammatory activity

Twaij *et al*, (1998) reported significant analgesic activity of *Pimpinella anisum* agianst benzoquinone induced writhing and in thermal tests. In another study it has been reported that the essential oil as well as fixed oil of *Pimpinella anisum* has a significant analgesic and anti-inflammatory effects (Tas *et al*., 2006).

Antioxidant Activity

In a study conducted by Gulcin *et al*., (2003) the antioxidant property of water and ethanolic extracts of aniseeds was evaluated and compared with synthetic antioxidants such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT) and α-tocopherol. Both extracts of aniseeds showed strong antioxidant activity. Rajeshwari *et al*., (2011) has reported *in vitro* and *in vivo* antioxidant potential of ethanolic extract of aniseeds, and proved scavenging activity. Similarly, the antioxidant potential of essential oil and oleoresins from anise seeds was studied, and showed highest antioxidant activity (Singh *et al*., 2008). Screening of antioxidant properties of some Umbelliferae fruits were done in Iran (including *Pimpinella anisum*), among them P. anisum extract showed the strongest activity. Further, a positive correlation was found between the antioxidant potency and flavonoid content of the fractions (Nickavar *et al*., 2009). In another study, water and alcohol extracts of anise seeds showed marked antioxidant activity (Ismail *et al*., 2004). An in vitro study of herbal tea of anise seeds showed antioxidant activity (Speisky *et al*., 2006).

Anticonvulsant activity

Anticonvulsant effects of essential oil of the fruits of *Pimpinella anisum* were reported against seizures induced by pentylenetetrazole (PTZ), maximal electroshock (MES) in male mice (Pourgholami *et al*., 1999); and picrotoxin-induced seizure in mice (Ghani *et al*., 1987; Heidari *et al*., 2005).

The cellular mechanisms probably produce hyper excitability, and causes enhancement of Ca_2+ channels activity or inhibition of voltage and/or Ca_2+ dependent K+ channels activity underlying post-hyperpolarization potential (Janahmadi *et al*., 2008).

Antiviral activity

The antiviral activity of its essential oil has been shown against PVX (potato virus), TMV (tobaccomosaic virus) and TRSV (tobacco ring spot virus by Shukla (1989).

Similarly, three lignin-carbohydrate-protein complexes (LC_1, LC_2, and LC_3) were isolated from a hot water extract of seeds of *Pimpinella anisum* showed antiviral activities against herpes simplex virus types 1 and 2, human cytomegalo virus, and measles virus (Lee *et al*., 2011).

Antidiabetic activity

The antidiabetic, hypolipidemic, and antioxidant activities of aniseeds showed a significant decrease in fasting blood, serum cholesterol, triglycerides and lipid peroxidation in RBC and plasma, and also rise in vitamin C was detected (Rejeshwari *et al*., 2011). Kreydiyyeh *et al*., (2003) reported that aniseed oil increased glucose absorption in the rat jejunum significantly, because the oil enhanced the activity of the Na^+-K^+ ATPase which increases the sodium gradient that gears the mucosal glucose transport.

Effect on gastrointestinal system

Acute gastric ulcer in rat was produced by various noxious chemicals and indomethacin showed a protective effect (Mofleh *et al*., 2007). The laxative efficacy of a phytotherapic compound containing *Pimpinella anisum* L., *Foeniculum vulgare* Miller, *Sambucus nigra* L., and *Cassia angustifolia* was reported in a randomized clinical trial, which included 20 patients with chronic constipation according to the criteria of the American Association of Gastroenterology (Picon *et al*., 2010). In a double blind clinical trial, the effect of anise extract on menopausal hot flashes for 4 weeks showed a significant reduction (Nahidi *et al*., 2008).

Muscle relaxant activity

The relaxant effect of *Pimpinella anisum* on isolated guinea pig tracheal chains and its possible mechanism were studied. The results showed that the relaxant effect of this plant is due to inhibitory effects on muscarinic receptors (Boskabady *et al*., 2001). In another study, antispasmodic and relaxant effects of three hydroalcoholic extracts of the aerial parts of *Pimpinella anisum* on rat anococcygeus smooth muscle showed good results (Tirapelli *et al*., 2007).

Dysmenorrhea

The effectiveness of a herbal capsule containing dried extracts of celery, saffron, and anise was compared with mefenamic acid in 180 females with primary dysmenorrhea. The results revealed that the efficacy of capsule was better than mefenamic acid in pain relief (Khoda *et al*, 2008).

Morphine dependence

The effects of anise oil were studied in mice on the expression and acquisition of conditioned place preference (CPP) induced by morphine. The findings showed that injection of essential oil of *P. anisum* has some aversive effects against

morphine induced conditioned aversion. In addition, this oil has also a GABA ergic effect (Sahraei *et al*., 2002).

Insecticidal activity

Essential oil of *Pimpinella anisum* by fumigation assay exhibited insecticidal activities against larvae of Lycoriella (Park *et al*., 2006). Prajapati *et al*., (2005) showed that the essential oils of *Juniperus macropoda* and *Pimpinella anisum* were highly effective as larvicidal and ovicidal against three mosquito species. In addition, the anise essential oil showed repellency against mosquito *Culex pipiens* (Erler *et al*., 2006). The exposure to vapours of essential oils from anise and cumin resulted in 100% mortality of the eggs (Tunc *et al*., 2000). The ascaricidal activity of p-anisaldehyde derived from anise seed oil against the house dust mites, Dermatophagoides farina has also been shown (Lee, 2004).

Conclusion

Anisoon is one of the important medicinal plants used in Unani system of medicine. In the classical literature, it has been described to be widely used as Kasir-e-riyah, Mohallil-e-Riyah, Muqawwi-e-Meda, Mushtahi, Mufatteh, Mufatteh Sudad, Munaffis-e- Balgham, Mukhrij-e-Balgham, Muddir-e-Bol. The recent studies especially on seeds and essential oil have demonstrated that it has antioxidant, antibacterial, antifungal, anticonvulsant, anti-inflammatory, analgesic, gastro-protective, antidiabetic and antiviral etc activities and various therapeutic uses supporting its therapeutic value of centuries and exposing it for further researches.

Acknowledgement

We are thankful to the President of Al-Jamiatul Mohammadia Al-Khairiya, Mr. Arshad Mukhtar, for providing the facilities to conduct the research.

References

Akhtar., Deshmukh, A. A., Bhonsle, A.V., Kshrirsagar, P. M., and Kolekae, M. A., 2008. In vitro Antibacterial activity of *Pimpinella anisum* fruit extracts against some pathogenic bacteria. *Veterinary World* 1(9): 272–74.

Al-Bayati, F.A., 2008. Synergistic antibacterial activity between *Thymus vulgaris* and *Pimpinella anisum* essential oils and methanol extracts, *Journal of Ethnopharmacology*, 116 (3): 403–06.

Ali, S.S., 1993. Unani Advia Mufarda, NCPUL, New Delhi, p. 56.

Anonymous, 2000. PDR for Herbal Medicine, Medical Economics Company, Montvale, NJ, pp.35-36.

Anonymous, 2005. The Wealth of India, Vol-I, NISCAIR, CSIR, pp. 61-63.

Anonymous, 2007. Unani Pharmacopeia of India, Part –I, Vol. II, CCRUM, New Delhi pp. 9-10.

Ates, D. A. and Erdogrul, O.T., 2003. Antimicrobial activities of various medicinal and commercial plant extracts, *Turkish Journal of Biology* 27: 157–62.

Baghdadi, H., 2005. Kitabul-Mukhtarat Fit-Tib, Vol 2, CCRUM, New Delhi, pp 61- 62.

Boskabady, M. H. and Ramazani-Assari, M., 2001. Relaxant effect of *Pimpinella anisum* on isolated guinea pig tracheal chains and its possible mechanism(s), *Journal of Ethnopharmacology* 74 (1): 83–88.

Burkhardt, G., Reichling, J., Martin, R., and Becker, H., 1986. Terpene hydrocarbons in *Pimpinella anisum* L, *Pharmaceutisch Weekblad* 8 (3): 190–93.

Chaudhry, N. M. and Tariq, P., 2006. Bactericidal activity of black pepper, bay leaf, aniseed and coriander against oral isolates, *Pakistan Journal of Pharmaceutical Sciences,* 19 (3): 214–218.

Denev, R. V., Kuzmanova, I. S., Momchilova, S. M., and Nikolova-Damyanova, B. M., 2011. Resolution and quantification of isomeric fatty acids by silver ion HPLC: fatty acid composition of aniseed oil (*Pimpinella anisum,* Apiaceae), *Journal of AOAC International* 94(1): 4–8.

Dirks, U. and Herrmann, K., 1984. 4-(*β*-d-glucopyranosyloxy) benzoic acid, a characteristic phenolic constituent of the Apiaceae, *Phytochemistry* 23(8):1811–1812.

Embong, M. B., Hadziyev, D., and Molnar, S., 1997. Essential oils from spices grown in Alberta. Anise oil (*Pimpinella anisum*), *Canadian Journal of Plant Science* 57: 681–688.

Erler, F., Ulug, I., and Yalcinkaya, B., 2006. Repellent activity of five essential oils against Culex pipiens, *Fitoterapia* 77(7): 491–494.

Evans, W. C., 2002. Trease and Evans Pharmacognosy, 15th edition, W. B. Saunders, pp. 368, 453, 457, 480.

Fujimatu, E., Ishikawa, T., and Kitajima, J., 2003. Aromatic compound glucosides, alkyl glucoside and glucide from the fruit of anise, *Phytochemistry* 63(5): 609–616.

Ghani, N.K., 2011. *Khazain-ul-Advia*, Idara-e-Kitabush-shifa, New Delhi, pp. 293.

Ghani, S., El-Lati S.G., and Sacaan, A. I., 1987. Anticonvulsant effects of some Arab medicinal plants, *International Journal of Crude Drug Research* 25(1): 39–43.

Gilligan, N. P., 2005. The palliation of nausea in hospice and palliative care patients with essential oils of *Pimpinella anisum* (aniseed), *Foeniculum vulgare var. dulce* (sweet fennel), *Anthemis nobilis* (Roman chamomile) and *Mentha x piperita* (peppermint), *International Journal of Aromatherapy* 15(4): 163–67.

Gulcin., Oktay M., Kirecci E., and Kufrevioglu O. I., 2003. Screening of antioxidant and antimicrobial activities of anise (*Pimpinella anisum* L.) seed extracts, *Food Chemistry* 83(3):371–82.

Hakim, M. A., 1999. Bustanul Mufradat, Idara-e-Kitabush-shifa, New Delhi, pp. 75.

Heidari, M. R. and Ayeli, M., 2005. Effects of methyl alcoholic extract of *Pimpinella anisum* on picrotoxin induced seizure in mice and its probable mechanism, *Scientific Journal of Kurdistan University of Medical Science* 10(3): 1–8.

Ibn Baitar.,YNM. Al Jam-e-yul Mufradat ul Advia wal Aghzia, (Urdu translation). Vol- I, CCRUM, New Delhi, pp. 144-145.

Jamshidzadeh, A., Heidari, R., Razmjou, M., Karimi, F., Moein, M.R., Farshad., 2015. An in vivo and in vitro investigation on hepatoprotective effects of *Pimpinella anisum* seed essential oil and extracts against carbon tetrachloride induced toxicity. *Iran J Basic Med Sci* 18(2): 205-211.

Janahmadi, M., Farajnia, S., Vatanparast, J., Abbasipour, H., and Kamalinejad, M., 2008. The fruit essential oil of *Pimpinella anisum* L. (Umblliferae) induces neuronal hyperexcitability in snail partly through attenuation of after-hyperpolarization, *Journal of Ethnopharmacology* 120(3): 360–365.

Jeelani, G., 2005. Makhzan-ul-Ilaj, Idara-e-Kitabush-shifa, New Delhi, pp. 651-652.

Kabiruddin, M., YNM. Makhzan-ul-Mufradat almaruf Khawasul Advia, Maktaba Naeemia, 100-101.

Kareem, H.N., YNM. Tarjuma makhzanul Advia ba zuban Urdu, Vol-1, Munshi Nawal Kishore, 99-100.

Khare, C.P, 2004. Encyclopedia of Indian Medicinal Plants, Springer Berlin, Heidelberg, New York, pp. 362-363.

Khoda, K.N., Moattar F., and Ghahiri, A., 2008. Comparison of effectiveness of an herbal drug (celery, saffron, Anise) and mephnamic acid capsule On primary dismenorrhea, *Ofoghe Danesh* 14(1): 11–19.

Kokate, C.K., Purohit, A. P, Gokhale., 2007. Text book of Pharmacognosy, 39th edition, Nirali Prakashan, Pune, pp. 368-369.

Kreydiyyeh, S.I., Usta, K., Knio, J., Markossian, S., and Dagher, S., 2003. Aniseed oil increases glucose absorption and reduces urine output in the rat, *Life Sciences* 74(5):663–673.

Kunzemann, J., and Herrmann, K., 1977. Isolation and identification of flavon(ol)-O-glycosides in caraway (*Carum carvi* L.), fennel (*Foeniculum vulgare* Mill.), anise (*Pimpinella anisum* L.), and coriander (*Coriandrum sativum* L.), and of flavon-C glycosides in anise—I. Phenolics of spices, *Zeitschrift f˙ur Lebensmittel Untersuchung und -Forschung* 164(3): 194–200.

Lee H. S., 2004. *p*-anisaldehyde: acaricidal component of *Pimpinella anisum* seed oil against the house dust mites Dermatophagoides farinae and Dermatophagoides pteronyssinus, *Planta Medica* 70(3): 279–281.

Lee, J. B., Yamagishi C., Hayashi K., and Hayashi T., 2011. Antiviral and immune stimulating effects of lignin-carbohydrate protein complexes from *Pimpinella anisum, Bioscience, Biotechnology and Biochemistry* 75(3): 459–465.

Mobeen, A., Parray, S.A., Ansari, A.A., Ahmad, T., Zohaib, S., 2017. Mundi: an important medicinal plant of unani system of medicine, *Journal of AYUSH: Ayurveda, Yoga, Unani, Siddha and Homeopathy* 6(1): 42-49.

Mofleh, A. Al., Alhalder, A. A., Mossa, J. S., Al- Soohalbani, M. O., and Rafatullah S., 2007. Aqueous suspension of anise *Pimpinella anisum* protects rats against chemically induced gastric ulcers, *World Journal of Gastroenterology* 13(7): 1112–1118.

Nadkarni K.M., 2007. Indian Materia Medica, Popular Prakashan, Bombay, vol. 1, pp. 955-956.

Nahidi, F., Taherpoor, M., Mojab, F., and Majd, H., 2008. Effect of Anise extract on hot flush of menopause, *Pajoohandeh* 13(3): 167–173.

Nickavar and Abolhasani FAS., 2009. Screening of antioxidant properties of seven Umbelliferae fruits from Iran, *Pakistan Journal of Pharmaceutical Sciences* 22(1):30-35.

Ozcan, M. M. and J. C. Chalchat J. C., 2006. Chemical composition and antifungal effect of anise (*Pimpinella anisum* L.) fruit oil at ripening stage, *Annals of Microbiology* 56(4): 353–358.

Orav, R.A., and Arak, E., 2008. Essential oil composition of *Pimpinella anisum* L. fruits from various European countries, *Natural Product Research* 22(3): 227–32.

Park, K., Choi, K.S., Kim, D. H., 2006. Fumigant activity of plant essential oils and components from horseradish (*Armoracia rusticana*), anise (*Pimpinella anisum*) and garlic (*Allium sativum*) oils against Lycoriella ingenua (Diptera: Sciaridae), *Pest Management Science* 62(8): 723–728.

Parray, S.A., Bhat, J.U., Ahmad, G., Jahan, N., Sofi, G. and IFS, M., 2012. Ruta graveolens: from traditional system of medicine to modern pharmacology: an overview. *Am J Pharm Tech Res* 2(2): 239-252.

Picon, P.D., Picon, R. V., Costa, A. F., 2010. Randomized clinical trial of a phytotherapic compound containing *Pimpinella anisum, Foeniculum vulgare, Sambucus nigra,* and Cassia augustifolia for chronic constipation, *BMC Complementary and Alternative Medicine* 10(1): 17

Pourgholami, M. H., Majzoob, S., Javadi, M., Kamalinejad, M., Fanaee, G. H. R., and Sayyah, M., 1999. The fruit essential oil of *Pimpinella anisum* exerts anticonvulsant effects in mice, *Journal of Ethnopharmacology* 66(2): 211–215.

Prajapati, N.D., Purohit, S. S., Sharma, A.K., Kumar, T.A., 2003. Handbook of Medicinal Plants, Agrobios India, p. 398.

Prajapati, V., Tripathi, A. K., Aggarwal, K. K., and Khanuja, S. P. S., 2005. Insecticidal, repellent and oviposition-deterrent activity of selected essential oils against Anopheles stephensi, Aedes aegypti and Culex quinquefasciatus, *Bioresource Technology* 96(16): 1749–1757.

Rajeshwari, U., Abirami, M., and Andallu, B., 2011. *In vitro* and *in vivo* antioxidant potential of aniseeds (*Pimpinella anisum*), *Asian Journal of Experimental Biological Sciences* 2(1): 80–89.

Ramlubhaya, R., 2004. Goswami Bayan-ul-Advia. Vol. I, Goswami Pharmacy, Old Delhi, pp. 85-87.

Rodrigues, V. M., Rosa, P. T. V., Marques, M. O. M., Petenate, A. J., and Meireles M. A. A., 2003. Supercritical extraction of essential oil from aniseed (*Pimpinella anisum* L) using CO2: solubility, kinetics, and composition data, *Journal of Agricultural and Food Chemistry* 51(6): 1518–1523.

Sahraei, H., Ghoshooni, H., Hossein, S. S., 2002. The effects of fruit essential oil of the *Pimpinella anisum* on acquisition and expression of morphine induced conditioned place preference in mice, *Journal of Ethnopharmacology* 80(1): 43–47.

Shobha, R.I., Rajeshwari, C.U., Andallu, B., 2013. Anti-peroxide and Anti diabetic activities of Aniseeds (*Pimpinella anisum* L.) and identification of bioactive compounds. AJPCT 1(5): 516-527.

Shojaii, A., and Abdollahi, F.M., 2012. Review of pharmacological pharmacological properties and chemical constituents of *Pimpinella anisum, ISRN Pharmaceutics* 2012: 1-8.

Shukla, H. S., 1989. Antiviral properties of essential oils of *Foeniculum vulgare* and *Pimpinella anisum* L. *Agronomie* 9(3): 277–79.

Shukla, H. S., and Tripathi, S. C., 1987. Antifungal substance in the essential oil of anise (*Pimpinella anisum* L.), *Agricultural and Biological Chemistry* 51(7): 1991–1993.

Singh, G., Kapoor, I.P.S., Singh, P., de Heluani, C. S., and Catalan, C. A. N., 2008. Chemical composition and antioxidant potential of essential oil and oleoresins from anise seeds (*Pimpinella anisum* L.), *International Journal of Essential Oil Therapeutics* 2(3): 122–130.

Speisky, H., Rocco, C., Carrasco, C., Lissi, E. A., and L´opez-Alarc', C. 2006. Antioxidant screening of medicinal herbal teas, *Phytotherapy Research* 20(6): 462–467.

Tariq Ahmad., 2010. Tajul Mufradat, Idara-e-Kitabush-shifa, New Delhi, pp. 100-102.

Tas, Ozbek H., Atasoy, N., Altug ,M. E., and Ceylan, E., 2006. Evaluation of analgesic and antiinflammatory activity of *Pimpinella anisum* fixed oil extract, *Indian Veterinary Journal* 83(8): 840–843.

Tirapelli, R., de Andrade, C. R., Cassano, A. O., 2007. Antispasmodic and relaxant effects of the hydroalcoholic extract of *Pimpinella anisum* (*Apiaceae*) on rat anococcygeus smooth muscle. *Journal of Ethnopharmacology* 110(1): 23–29.

Tunc Berger, B. M., Erler, F., and Dagli, F., 2000. Ovicidal activity of essential oils from five plants against two stored-product insects, *Journal of Stored Products Research* 36(2): 161–168.

Twaij, H. A. A., Elisha, E. E., Khalid, R. M., and Paul, N. J., 1988. Analgesic studies on some Iraqi medicinal plants, *International Journal of Crude Drug Research* 25 (4): 251–254.

Yazdani, D., Rezazadeh, S., Amin, G., Zainal-Abidin, M. A., Shahnazi S., and Jamalifar, H., 2009. Antifungal activity of dried extracts of anise (*Pimpinella anisum* L.) and star anise (Illicium verum Hook, f.) against dermatophyte and saprophyte fungi, *Journal of Medicinal Plants* 8(5): 24–29.