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Original Article

THE THERAPEUTIC USES AND PHARMACOPEAL ACTION OF *JIRJEER* (*Eruca sativa*): A Review

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ABSTRACT

The Unani System of Medicine (USM) is one of the traditional systems of medicine that deals with plants. Plants are large source of medicine. *JIRJEER* (*Eruca sativa*) is one of the plant origin drugs, has been used for various therapeutic purposes in USM. It contains Erucic acid (major contain), oleic acid, linoleic acid, saturated Fatty acids, Flavonoids, Phenolics, Glucosinolate, Vitamin C and Carotenoids. These active constituents are responsible for their actions described in Unani classical literature such as *Muqqawwi-e-bah* (Aphrodisiac), *Muwallid-e-mani* (Spermatomatogenic), *Daf-e-sumoom* (Antidote), *Kasir-e-riyah* (Carminative), *Jaali* (Cleanser/Detergent), *Mudirr-e-bawl* (Diuretic) *wo Mudirr-e-hayd* (Emmenogoggue), *Muhammir* (Rubefacient), *Hazim* (Digestive), Mulaiyan (Laxative), *Muzliq-e-mani* (Lubricant), *Muddir-e-shir* (Galactopoietic), *Mufattih-e-Sudad* (Deobstruent), *Musakhin* (Analgesic), *Mulattif* (Demulcent), *Mufattit-i-hasah* (Lithotriptic) and whole plant is considered as aphrodisiac. This is a review paper which discusses morphology, pharmacological action, ethno-medicinal and therapeutic uses of this medicinal plant in perspective of Unani medicine. This review has been done through online searches of databases such as PubMed, Google Scholar, Embase, science direct and hand search for classical textbook available in different libraries. It concluded that *JIRJEER* (*Eruca sativa*) is one of the best herbal medicines in treatment of Antiulcer, Antibacterial, Fertility, Hepato-protective, Hyperlipidemic, Antioxidant, Antihypertensive, Anti-inflammatory and Anti-edema, Nephro-protective, Antidiabetic, Antifungal and Anticancer properties.

Keywords Antihypertensive, Aphrodisiac, Anticancer, Nephro-protective, Spermatomatogenic, Unani System of Medicine (USM).

INTRODUCTION

The Unani System of Medicine (USM) is one of the traditional systems of medicine that deals with plants, mineral and animal origin drugs. Plants are large source of medicine because of their active chemical constituents or substances, which are used in pharmaceutical companies for production of conventional medicines. In developing countries 90% of population use traditional medicine for their primary health care because of its easy availability, cheaper in price and with fewer side effects. Traditional System of medicine plays an important role for preventive, curative, promotive and rehabilitative health care in adopting holistic approach. Plants medicine are not only used for treatment of particular diseases but also for diseases of all the systems of the human body. *JIRJEER (Eruca sativa)* is one of the plant origin drugs. It has been used for various therapeutic purposes in USM. Unani classical literature described its actions such as *Muqqawwi-e-bah* (Aphrodisiac), *Mudirr-e-bawl* (Diuretic) *wo Mudirr-e-hayd* (Emmenogoggue), *Muwallid-e-mani* (Spermatomatogenic), *Kasir-e-riyah* (Carminative), *Jaali* (Cleanser/Detergent), *Muhammir* (Rubefacient), *Hazim* (Digestive), *Daf-e-sumoom* (Antidote), *Mulaiyan* (Laxative), *Muzliq-e-mani* (Lubricant), *Muddir-e-shir* (Galactopoietic), *Mufattih-e-Sudad* (Deobstruent), *Musakhin* (Analgesic), *Mulattif* (Demulcent), *Mufattit-i-hasah* (Lithotriptic) (Hakeem; 2002, Khan, Tarique, 2010, 2013; Ghani, 1998). The medicinal effects of leaves are stimulant, stomachic, diuretic and antiscorbutic. Seeds are vesicant and acrid, oil from seeds contains glycerides of erucic acid and whole plant is considered as aphrodisiac (Pullaiah, 2006; Kirtikar and Basu, 1918).

Eruca sativa is an annual herb diploid (2n = 22) in nature belongs to Brassicaceae family. In Unani system of medicine commonly known as *JIRJEER* (*Eruca sativa*), it has 350 genera and about 3,500 species having medicinal values. It is about 1 to 1.5 feet long and is widely grown all over world. It mainly originated from Mediterranean region, Middle-East, South Asia, North Africa, Iran and Pakistan and in India it is mostly

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cultivated in Haryana, Punjab and around Delhi (Tarique, 2010; Bansal, 2015; Cavaiuolo, 2014; Garg, 2014). Mostly fresh part of the plant is used in salad and seasonally it is cooked. *Eruca sativa* is a winter crop (Rabi) of drier areas and can be sowing on soils limited in moisture supply. *Eruca sativa* can grow on severely salt-affected soils and tolerate temperatures down to −4°C. It is also a cosmopolitan weed and a host for several fungi and viruses that attack other cruciferous crops (Garg, 2014). It has two types: wild and domestic, Wild type known as "*Harsha*" or "*Aehqan*", Domestic type also known as "*Baqla-e-ayesha*". In USM seeds, juice, leaves, flowers and whole plant are used for various therapeutic purposes, mostly for skin disorders mainly for hyperpigmentation, ringworm and acne vulgaris. Wild type has more medicinal value than Domestic type (Ghani, 1998; Khan, 2013; S Jaafar, 2019). Leaves are compound fleshy, toothed; flowers are large in size with 2–4 cm in diameter, bisexual and yellow or white in color characterized by pungent smell. Fruits are cylindrical siliquae in shape with a flattened beak 3–4 mm long. Seeds are spherical or ovoid extended from 1.5 to 2 mm, pale brown to olive green shade, and set in to 2 or 3 rows on each side. Fruit pod are ovoid-oblong with a large ensiform, seedless beak. Rapidly grown in cold (Rabi) climatic condition and also tolerate hot weather (S Jaafar, 2019; Garg, 2014; Kirtikar, 1918). Seeds are rich in oil, which are used for cooking in the place of mustard oil for better taste (S Jaafar, 2019). It contains Erucic acid (major contain), oleic acid, linoleic acid, and saturated fatty acids. Seeds have active constituent's flavonoids, phenolics, glucosinolate, vitamin c, carotenoids and these active constituents are responsible for their actions (Somos, 2007; Alqasoumi, 2010; Gugliandolo, 2018; Baeshen, 2016).

COMMON VERNACULAR NAMES

English; Rocket, French; Roquette, Sanskrit; Bhutagna, Siddartha, Bengal; Shwetsursha, North-western provinces; Duan, Tara, lalu, sahwan, Taramira, Punjab; Assu, Tara, Jumba, Usan, French; Roquette, Persian; Jambeh, Hindi; Taramira, Spanish; Oruga, Roqueta. Also known as "cultivated" rocket, "annual" rocket, "true" rocket, arugula, roquette, "white pepper", or taramira (Kirtikar and Basu, 1918).

BOTONICAL DESCRIPTION (Marwat, 2016)

Taxonomy Kingdom	Plantae
Sub-kingdom	Tracheobionta
Super- division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Brassilcales
Family	Brassicaceae
Genus	*Eruca*
Species	*Eruca sativa*
Botanical name	*Eruca sativa*

TEMPERAMENT

In USM physicians have attributed the particular characteristic known as temperament to every single drug used as therapeutic agent. This parameter is considered while prescribing medicine to the patients. Temperament of *JIRJEER* (*Eruca sativa*) is described as "*Har[3] Yabis[3]"*. This is a unique feature of therapeutics in USM. Temperament of a drug signifies that this medicine may not have same effectiveness in the patient having the same temperament, but may be effective in patient having just opposite temperament. This consideration of temperaments of the medicine and the patient for prescription, indicates that USM has unique approach of personalized medicine (Khan, 2013; Tarique, 2010).

DOSAGE AND SUBSTITUTE

Oral dosage of seeds of *JIRJEER* (*Eruca sativa*) is recommended in the range of 1-3 gm per day (Kabeeruddin, 2000). If Domestic (Garden) type is taken as per recommendation is 17.5 gm and wild in the range of 7-10.5 gm (Khan, 2013). In USM, physicians have identified substitute of every single drug so that the substitute can be used in place of unavailable drug. In this case *Husn-e-yusuf*, is considered as the best substitute to *JIRJEER* (*Eruca sativa*) because it has similar medicinal properties (Kabeeruddin, 2000). For seeds of Domestic *JIRJEER* (*Eruca sativa*) its substitute is seeds of *Piyaz (Allium cepa Linn),* seeds of *Gazar (Daucus carot Linn.),* and for wild *JIRJEER* (*Eruca sativa*) seeds of *Khurdal (Brassica nigra Linn.)* is taken as best substitute (Khan, 2013; Ghani, 1998).

ADVERSE EFFECT WITH MUSLEH (CORRECTIVES)

Most commonly whole plant adversely affects to the People having hot temperament (Tarique, 2010). Seeds of *JIRJEER* (*Eruca sativa*) cause weakness of eye site, vertigo, than its *musleh* (corrective) is *Badam (Prunus amygdalus linn)*. If seeds of *JIRJEER* (*Eruca sativa*) can adversely cause headache than use *Isabgol (Plantago ovata)* as *musleh* (corrective). When seeds of *JIRJEER* (*Eruca sativa*) adversely effect on bladder than *Katira (Cocchlospermum religiosum Linn)* is used as a corrective. If participants over consume seeds of *JIRJEER* (*Eruca sativa*) that lead to *hizyaan-e-khoon* (irritability to the blood) than milk is used as a corrective.

AFAAL (ACTIONS)

Muqqawwi-e-bah (Aphrodisiac), *Mudirr-e-bawl* (Diuretic) *wo Mudirr-e-hayd* (Emmenogoggue), *Muwallid-e-mani* (Spermatomatogenic), *Kasir-e-riyah* (Carminative), *Jaali* (Cleanser/Detergent), *Muhammir* (Rubefacient), *Hazim* (Digestive), *Daf-e-sumoom* (Antidote), *Mulaiyan* (Laxative), *Muzliq-e-mani* (Lubricant), *Muddir-e-shir* (Galactopoietic), *Mufattih-e-Sudad* (Deobstruent), *Musakhin* (Analgesic), *Mulattif* (Demulcent), *Mufattit-i-hasah* (Lithotriptic) (Hakeem; 2002, Khan, 2013; Tarique, 2010; Ghani, 1998). The medicinal effects of leaves are stimulant, stomachic, diuretic and antiscorbutic. Seeds are vesicant and acrid, oil from seeds contains glycerides of erucic acid and whole plant is considered as aphrodisiac (Pullaiah, 2006; Kirtikar and Basu, 1918).

THERAPEUTIC USES IN UNANI MEDICINE

Dermatological diseases: Improve fairness, Pityriasis nigra, hyperpigmentation, Melasma, Black spots, Acne vulgaris, Vitiligo, Hair re-growth, Freckles, Itching and Nail fissure (Khan, 2013; Ghani, 1998). **Gynecological Disease:** Amenorrhea and Dysmenorrhea (Hakeem, 2002). **Renal Diseases:** Dysuria and Kidney stone (Khan, 2013). **Others:** Liver and spleen obstruction, Antidote for mongoose, increase sexual power, Improve the body health and Dysentery (Baitar, 1982; Khan, 2013). Flowers and seeds of domestic *JIRJEER* (*Eruca sativa*) are used to increase

Quwwat-e-jema (sexual power) (Baitar, 1982). Seeds also have *muddir-e- bowl* (Diuretic), *hazim* (Digestive) and *mulyain* (Laxative) properties (Khan, 2013). Seeds are also used in form of paste on face to remove black spot and improve fairness of skin (Khan, 2013). Seeds paste with honey is very effective in treatment of pityriasis nigra, melasma, freckles and hyperpigmentation and also act as antidote for the treatment of mongoose bite (Ghani, 1998; Khan, 2013). Seeds act as *muqqawwi-e-bah* (aphrodisiac), *moharrik-e-bah* (sex stimulant) and *muwallid-e-mani* (spermatomatogenic). Seeds used with hot water act as expectorant (Khan, 2013; Baitar, 1982). Seeds having properties like *muddir-e-bowl* (diuretic) wo *laban (*galactogogue) increases the volume of milk and urine (Khan, 2013; Ghani, 1998). Fine powder of it, is used locally for the treatment of acne vulgaris and its spots. *JIRJEER* (*Eruca sativa Linn*) with *sirka* (vinegar) is used to remove hyperpigmentation of the face and the body (Baitar, 1982). When it is used with half boil egg act as *moharrik-e-bah* (sex stimulant) (Khan, 2013; Ghani, 1998). *JIRJEER* (*Eruca sativa*) used as liniment for melasma, pityriasis and baras (Khan, 2013; Ghani, 1998). Its oil is used for itching, Leaves are used as eminent. *Chana* (chickpea) soaked in water of *JIRJEER* (*Eruca sativa*) act as *muwallid-e-mani* (spermatomatogenic) and also increases sexual power (Khan, 2013). *JIRJEER* (*Eruca sativa*) having *kasir-r-riyah* (Carminative) properties, used in cooking helps in digestion (Tarique, 2010). These properties are present in all parts of the plant but its seeds are rich source (Khan, 2013). Wild seeds are *muqawwi* (tonics) in these properties (Khan, 2013). Juices are used in acne vulgaris and post inflammatory hyperpigmentation (Khan, 2013). Oral and local use of seeds are effective in calf muscle pain (Khan, 2013). Oil extract from seeds have soothing effect on skin, used for soap manufacture and is used in cooking, also with sugar (oral) is effective in treatment of dysentery. Lotion of *JIRJEER* (*Eruca sativa*) promotes hair re-growth and reverse greasy scalp (Ramzan, 2015; Dris, 2002; Abbasi, 2013).

CHEMICAL CONSTITUENT

Seeds: seeds extract have seven fatty acids such as myristic acid, palmitic acid, stearic acid, linoleic acid, linolenic acid, erucic acid, and oleic acid, cosaenoic acid C20, nervonic acid C24 acid and volatile constituents such as myristicin, terpineol, apiole, cis-verbenol, and β- phellandrene are detected. Hexane extracts shows β-sitosterol, cholesterol, stigmasterol, campesterol and volatile constituents are myristicin, terpineol, apiole, cis-verbenol, and β-phellandrene. Alcoholic seeds extracts have Glucoerucin (S Jaafar N, 2019). Leaves: Leafs extracts having fatty acids such as palmitic acid, azelaic acid, trance-vaccenic acid ($C_{18}H_{34}O_2$), palmitoleic acid and linolenic acid. Hexane leaf extract have Cholesterol, secocholest-1(10)-en-3, 5-dione, β-sitosterol, and stigmasterol. Volatile constituents in leaves are eugenol, transanethole, elemene, (E)-b-damascone, Terpens as phytol, isophytol and squalene. Lutein (xanthophyll), α-tocopherol carotenoids, β-carotene (with provitamin activity), α-carotene, violaxanthin, antheraxanthin, zeaxanthin, neoxanthin by high-performance liquid chromatography (HPLC). Ethanolic extracts showed Kaempferol-3 glucoside (astragalin); kaempferol-3,diglucoside -7- glucoside; kaempferol-3,4 diglucoside, kaempferol 3-O-(2''-O-malonyl-βD-glucopyranoside)-4'-O-β-D glucopyranoside; kaempferol 3, 4'-di-Oglucopyranoside, 3-OMichael glucopyranoside, 4'-O-glucopyranoside; quercetin-3,4′-diglucoside-3′- (6-sinapoyl-glucoside); quercetin-3,3′,4′- triglucoside; quercetin-3-(2-sinapoylglucoside)-3′-(6-sinapoylglucoside)- 4′-glucoside; quercetin-3-β-D-glucoside; rutin; quercetin-3,4 -diglucoside-3 -(6-caffeoyl-glucoside); isorhamnetin-3-glucoside; isorhamnetin-3,4′-diglucoside; rhamnocitrin 3-O-(2''-O-methylmalonylβ-Dglucopyranoside)-4'-O-β-D-glucopyranoside, rhamnocitrin 3- O-glucopyranoside, 4'-O-glucopyranoside. Ellagic, tannic, and gallic acid; quercetin kaempferol; rhamnetin, quercetin triglucoside; rutin, monosynapoyl triglucoside; and kaempferol-3-O-galactoside were the phenolics detected in E. Sativa seed extract. Resorcinol and catechol, benzoic acid, ellagic acid, quercetin, and rutin are detected. Aqueous extract has Ferulic acid, coumaric acid, vanillin, resorcinol, and catechol (S Jaafar N, 2019). **Flowers:** Ellagic, tannic, and gallic acid; quercetin kaempferol; rhamnetin, quercetin triglucoside; rutin, monosynapoyl triglucoside; and kaempferol-3-O-galactoside were the phenolics detected in E. Sativa seed extract. Resorcinol and catechol, benzoic acid, ellagic acid, quercetin, and rutin, S-demethylation of 4-methylthiobutylglucosinolate (glucoerucin). 4-methylthiobutyl glucosinolate and 4-methylslfinylbutyl glucosinolate (S Jaafar N, 2019). **Roots:** Glucosinolates methylthiobutylglucosinolate, 4-mercaptobutyl glucosinolate, and 4-methylsulfinylbutylglucosinolate. Antioxidants compound such as carotenoids, flavonoids, glucosinolates and volatile oils like myristicin, apiole and phellandrene. Glucosinolate is obtained from *Eruca sativa* contain nitriles, isothiocyanates, and thiocyanates. Volatile fraction of *Eruca sativa* contains Nitrile, 5-methylthiopentanenitrile. Moreover, it is reported that rocket seed have high oil contents and its oil have aphrodisiac properties. Rocket is a rich source of minerals and electrolytes in leaves are phosphor (P), potassium (K), calcium (Ca), magnesium (Mg), sodium (Na), iron (Fe), copper (Cu), manganese (Mn), and zinc (Z). In seeds, the most abundant minerals are Ca, Na, P, and chromium (Cr) (S Jaafar, 2019).

PHARMACOLOGICAL ACTIVITY

ANTIULCER EFFECT

Helicobacter pylori bacteria can cause many diseases and ulcers such as chronic gastritis, gastric ulcer, duodenal ulcer, Peptic ulcer, gastric adenocarcinoma and gastric mucosa-associated lymphoid tissue lymphoma. In traditional medicine it plays an important role to kill bacteria. Urease enzyme is essential for growth, metabolism and colonization in gastric mucosa. In preclinical study by Alqasoumi S demonstrated, that Extract of *JIRJEER* (*Eruca sativa*) can significantly reduce urease activity, also Gastric ulcer induced by necrotizing agents like indomethacin and hypothermic agent can also be reduced by *JIRJEER (Eruca sativa),* which is confirmed histologically. Thus *JIRJEER* (*Eruca sativa*) reduced occurrence of above-mentioned diseases. *JIRJEER (Eruca sativa)* also reduced GWM, NP-SH levels and MDA level significantly. Study result proved that, ethanol extract of eruca significantly protect gastric mucosa against the depletion of gastric wall mucus due to acids, pepsin and necrotizing agents such as ethanol and indomethacin (Guenane, 2017; Alqasoumi, 2009)

ANTIBACTERIAL EFFECT

Antibacterial property of *JIRJEER* (*Eruca sativa*) is showed by its seeds and oil extract. Seeds have alkaloids, cardiac glycosides, flavonoids, phenolics, ascorbic acid, saponins and tannins and oil extract has both essential and non-essential

fatty acids mainly Erucic acid. The presence of phenolic compound showed antimicrobial properties against bacteria's. Tannin has antiviral, antibacterial, antitumor activity and diuretic properties. Cardiac glycosides are helpful in various diseases. Saponin has the property of precipitating and coagulating red blood cells (RBC). Erucic acid present in seeds oil is higher in concentration. It is responsible for antimicrobial activity, also have Mono and polyunsaturated fatty acids such as Oleic acids (15%), cis-11- eicosenoic acid, methyl ester (12.5%), linoleic acid and methyl ester (6.9%) were abundant. These fatty acids support edible uses. Seed oil and its methanolic extracts have shown higher antibacterial activity against Gram +ve and Gram –ve bacteria's. Mainly against S. aureus and B. cereus strains. Erucic acids and isothiocyanates were present in high concentration. These are responsible for antibacterial activity against Bacillus cereus, Pseudomonas aeruginosa, B. subtilis, Escherichia coli, Staphylococcus aureus, Vibrio parahaemolyticus and H. pylori. Hence it could be used for the preparation of drugs required for human and animal health (Barillari, 2005; Rizwana, 2016; Doulgeraki, 2017; Malik, 2015; Khoobchandani, 2010; Ettebong, 2009; Singh, 2016).

FERTILITY ACTION

Traditionally *JIRJEER* (*Eruca sativa*) is used for improvement of sexual power due to its aphrodisiac property. In preclinical study the aphrodisiac potential of *JIRJEER* (*Eruca sativa*) was demonstated. Ethanolic extract of *JIRJEER* (*Eruca sativa*) showed androgenic action as well as it induces testicular steroids production that stimulates the preputial gland, also enhances spermatogenesis in the male mice testis. Extract of leaves are considered for the rise of testosterone hormone level and increases sperm activity, moreover reduced death sperm and its abnormalities (Ansari, 2014; Hadi, 2017). The extract of *JIRJEER* (*Eruca sativa*) have saponins and alkaloids enhance sperm activity. Its histological examination showed a significant increase in diameter of its tubules, spermatids, and Leyding cells and also showed reduction in interstitial space. Rocket extract will increase the growth of testis and also enhances the spermatozoa proliferation and maturation. Seed oil also improves nicotine-induced testicular damage by morphometric and histological modification. This effect is due to desulfoglucosinolates, erucic acid and isothiocyanates. The combination of these phytochemicals are present in seeds, leaves and oil of *JIRJEER* (*Eruca sativa*). The study conducted by Mona *et al*., revealed that small doses of seeds oil stimulate spermatogenesis. Another study carried out by Nowfel AJ proved that hormonal assay showed a significant elevation in serum testosterone. Ethanolic extract of leaves significantly improved the testicular functions and spermatogenesis in stressed rats (Nowfel, 2017).

HEPATOPROTECTIVE EFFECT

Hepatotoxicity is one of the major problems all over the world. About 20,000 deaths occurs in each year. Nearly 2, 50,000 new cases of hepatocellular carcinoma are newly diagnosed (Kshirsagar, 2011). So there is need to search alternative treatment, hence various traditional medicines are center of attraction and they have been used as hepatoprotective for primary healthcare because of their medicinal activities and highly safety effect with fewer side effects. Conventional medicines such as steroids, antiviral, anti-tubercular drug (isoniazid and rifampicin) and vaccine give temporary benefits with serious risks of toxicity, if we use chronically. Bad habits like chronic alcoholism, viral infections, environmental pollution and chemical (paracetamol, carbon tetra chloride (CCL_4), thioacetamide), may directly effect on it and cause inflammation of liver tissues (Alter, 2006; Dienstag, 2001; Jaishree, 2010). Ethanolic and aqueous extracts of leaf proved hepatoprotective effect because it is rich in sulfur content. Which is responsible to expel body waste. This extract plays an important role in restoration of non-protein sulfhydryl in liver tissue, and are also responsible for liver immune functions. This extract suppresses cytochrome P450 oxygenase enzyme system, and it extract have major constituent that is glucoerucin which is having antioxidant action (S Jaafar, 2019; Alqasoumi, 2010; Salem, 2001).

HYPERLIPIDEMIC EFFECT

Extract of leaves having Vit-C of 7alpha-hydroxylase enzyme plays an important role in conversion of plasma cholesterol into bile acid, hence significantly reduce serum cholesterol and also prevent oxidation of high-density lipoprotein. Seeds oil have hypocholesterolemic effect due to their active constituents such as phytosterols; β-sitosterol, campasterol and beta-amyrine. These sterols decrease cholesterol concentration by preventing its absorption and inactivation of the hepatic cholesterol esterase. High ratio of unsaturated fatty acids decreases lipoproteins production. Phytosterols reduced the dietary and biliary cholesterol conjugation into micelles, and this depresses the cholesterol absorption. Synthesis of cholesterol and low-density lipoprotein (LDL) receptors activity are increased, which eventually leads to reduced serum LDL cholesterol concentration. The rocket oil hypocholesterolemic effect is better than olive oil. Hence rocket oil decreases the total cholesterol, total lipid, and LDL concentration. Hence it can be considered as worthy source for omega fatty acids. It might be consumed as a healthy oil to minimize saturated oil consumption. Saturated oils and fats are the big reasons for the development of several chronic illnesses (Bell, 2017; Shatta, 2014; Uzun, 2016; El-Gengaihi, 2004).

ANTIOXIDANT EFFECT

Flower extracts has a very powerful antioxidant effect. It could be estimated by radical scavenging test and β-carotene bleaching test. Phenolic compounds such as kaempferol 3; 4-di-O-glucoside, kaempferol 3-glucosyl, quercetin 3-glucosyl, and isorhamnetin 3-glucosyl are responsible for antioxidant activity (Koubaa, 2015). These phenolic compounds are responsible for scavenging free radicals. Seeds extract have major constituent glucoerucin, which is responsible for antioxidant action by scavenging hydrogen peroxide and alkyl hydro peroxides (Maia, 2015).

ANTIHYPERTENSIVE EFFECT

Traditionally *JIRJEER* (*Eruca sativa*) is used as a cardio-protective medicine, especially for hypertension. In preclinical study demonstrated, that methanolic extract of *JIRJEER* (*Eruca sativa*) showed hypotensive effect on hypertensive and normotensive rats by oral and intravenous administration. This action is due to vasodilatory and cardiotonic effects. Vasodilation action of *JIRJEER* (*Eruca sativa*) by acting on vasodilatory mediators (nitric oxide, certain muscarinic), which are presents on vascular endothelial cells has direct effect on vascular smooth muscle in rat. Flavonoids and phenols are present in ethyl acetate fraction; previous study proved that these constituents have anticholinesterase and cardioprotective effects. Quercetin and

erucin is a major component of *JIRJEER* (*Eruca sativa*) having antihypertensive effect (Ali-Shtayeh, 2013).

ANTI-INFLAMMATORY AND ANTIEDEMA EFFECT

Traditionally *JIRJEER* (*Eruca sativa*) and its oil is used in management of *waja-ul-mafasil*. Abodola *et al*., demonstrated anti-inflammatory effect of seeds of *JIRJEER (Eruca sativa)*. Ethanolic extract of seeds proved an anti-edema action. Seeds contain active constituents such as flavonoids, quercetin, isorhamnetin, 4-methylthiobutyl isothiocyanate (main isothiocyanates in seeds) and 4-methylthiobutyl isothiocyanate mainly responsible for anti-inflammatory action with gastroprotective effect (Rani, 2010).

NEPHROPROTECTIVE EFFECT

Eruca showed nephroprotective effect. The preclinical study carried out by *Elgazar* and his colleague demonstrated nephroprotective effect and diuretic properties against gentamicin-induced nephrotoxicity in rats. Alcoholic extract of seeds showed nephroprotective effect against mercuric chloride (Hg Cl2)-induced nephrotoxicity. This effect is due to antioxidant molecules, enzymes, Flavonoids and glucoerucin constituent plays an important role in nephroprotection. *Hussien* in his preclinical study carried out on rabbits proved that aqueous extract of E. sativa significantly reduced the occurrence of nephrocalcinosis (it is the condition of in which calcium level in kidney is more than normal), by suppressing calcium oxalate crystal formation and its deposition in renal tissues by their diuretic and alkalizer. *JIRJEER* (*Eruca sativa*) also reduced incidence of kidney stone mainly from calcium oxalate due to presence of large amount of magnesium which reduce the binding of oxalate to calcium ion in renal tubules. Hence calcium oxalate crystal formation is suppressed (Abodola, 2015; Elgazar, 2013; Shalaby, 2014; Sarwar Alam, 2007; Hussein, 2018; Aggarwal, 2013).

ANTIDIABETIC EFFECT

There are various medicines having antidiabetic properties. Rocket seeds is one of the medicines used traditionally for treatment of Diabetes. Streptozotocin (alkylating antineoplastic agent) is responsible for inducing diabetes in this situation. Rocket seeds oil directly act on Streptozotocin and produce antihyperglycemic effect in rats. In chronic diabetes, if glucose concentration is high that produce reactive oxygen species (ROS), and the development of advanced glycosylation end products. ROS activates lipid peroxidation that causes devastation and injury to the cell membrane. Lipid peroxidation is one of the distinctive features of chronic diabetes. Rocket seeds oil showed hypoglycemic activity by regulating pancreatic islets architecture, antioxidant activity and increasing insulin secretory response. E. sativa extract shows suppressing effect on carbohydrate metabolism through inhibition of carbohydrate-hydrolyzing enzymes such as α-amylase, α-glucosidase, and β-galactosidase in dose-dependent manner (Salma, 2018; Melchini, 2010; Peter, 2016; Hetta, 2014; Ahmed, 2016).

ANTIPLATELET EFFECT

In vivo and vitro study estimated that Hydroalcoholic extract of leaves have antiplatelet effect. Nowadays platelets aggregation is responsible for thrombus formation and many cardiovascular diseases. It prevents platelets aggregation without significant rise of bleeding. During inflammation, rise of inflammatory mediators are thromboxane B2, tissue growth factor (1β), and IL-1β. Which plays an important role for formation of atherosclerotic lesion and arterial thrombogenesis due to platelets aggregation on inflammatory site *JIRJEER* (*Eruca sativa*) extract prevent these phenomena. This activity of *eruca sativa* is due to existence of kaempferol, quercetin, and isorhamnetin constituents (Alarcón, 2014).

ANTIFUNGAL EFFECT

Traditionally oil is used for itching, when the cause of itching is due to fungal infections. Now many studies revealed antifungal properties assessed by well-diffusion method. Oil extracted from leaves by stream distillation showed significant antifungal properties against *Dreschlera halodes*, *Cola clavata*, *Rhizopus oryzae*, *aspergillus nidulans*, *Alternaria kiliense, Alternaria alternate* and *F. oxysporum*. Aqueous extract of seeds also showed antifungal effect against *Spadicoides stoveri* and *Paecilomyces variotii* (Ansari, 2014).

ANTI-CANCER ACTIVITY

Wild rocket plant has anti-cancerous and antioxidant properties through its constituents such as Isothiocyanates, sulforaphane and erucin [1-isothiocyanato-4-(methylthio) butane]. Through inhibition of Phase I carcinogen-activating enzymes, induction of Phase II carcinogen detoxification enzymes, inhibition of cancer cell proliferation by arresting cell cycle at G2/M, and removal of premalignant and malignant cells. Also, induction of apoptosis and increases expression of multidrug resistance transporters in human carcinoma cell lines. Erucin is major component, which plays an important role in lung carcinoma, breast cancer, hepatoma and leukemia cell lines by arresting cell cycle progression and induces apoptosis. Sulforaphane and erucin both inhibits proliferation and mitosis in MCF7 breast cancer cells in parallel with inhibition of cell cycle progression at G2/M and mitosis in a manner consistent with impairment of spindle microtubule dynamics witch strongly suppressed microtubule growing and shortening dynamics during interphase in preclinical study by Azarenko O (Azarenko, 2014).

CONCLUSION

Unani Medicine presents avenues in the search of new and alternative drugs. There are thousands of plants in Unani Medicine used as therapeutics for various ailments. These medicinal plants have promising future because most of them have not been investigated for pharmacological activities. The present review concludes that *JIRJEER (Eruca sativa)* demonstrated anti-diabetic, antioxidant, antihyperlipidemic, antiulcer, antibacterial, antifungal, anti-inflammatory activities in several preclinical studies. In clinical studies, *JIRJEER (Eruca sativa)* showed efficacy to control glucose, dyslipidaemia and bacterial infections. Pharmacological activities of *Eruca sativa* attribute to the alkaloids present in the whole plant, seeds, leave and Oil. This review suggests that *Eruca sativa* have immense potential to treat a wide variety of disease. Its therapeutic use as diuretic, galactogogue, emmenogoggue, lithotriptic and deobstruent have not been studied scientifically despite empirical evidences available in classical literature. In the light of this review, it can be said that *Eruca sativa may emerge as a potential drug for* diabetes mellitus type 2, dyslipidaemia, peptic ulcer, cancer, fairness of skin, ringworm, vitiligo, melasma, fertility and hypertension. Further rigorous studies are required to establish the efficacy of *Eruca sativa* as a

potent drug for antibacterial infections, skin disorders, nephroprotective and hypertentions.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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