

APIACEAE – THE BOON FOR WOMEN’S HEALTH- A REVIEW ARTICLE

Abstract

Apiaceae or *Umbelliferae* is a family of mostly aromatic flowering plants named after the type genus *Apium*. It is the 16th-largest family of flowering plants, with more than 3,700 species in 434 genera including such well-known and economically important plants such as ajwain, angelica, anise, asafoetida, caraway, carrot, celery, chervil, coriander, cumin, dill, fennel. Most of commonly available plants of *Apiaceae* family notably have pharmacological effect on female reproductive system. Many of them have phyto estrogenic effect, galactogogue effect, and contraceptive effect ect. Here, we present a review on effect of most commonly available plants of *Apiaceae* on female reproductive system.

Key words: *Apiaceae*, Reproductive system, phytoestrogen, abortifacient, antifertility.

Apiaceae or *Umbelliferae* is a family of mostly aromatic flowering plants named after the type genus *Apium*. It is the 16th-largest family of flowering plants, with more than 3,700 species in 434 genera including such well-known and economically important plants such as ajwain, angelica, anise, asafoetida, caraway, carrot, celery, chervil, coriander, cumin, dill, fennel.¹

The members of this family *Apiaceae* are distributed in most parts of the world. But they are commonly found in sub-tropical, north temperate regions. These plants are cultivated in India during winter season.²

Plants from *Apiaceae* family are commonly used for food, flavouring, fragrance and medical purposes; they are also known to be used as a household remedies since antiquity. Recently, many experimental and biological investigations have been carried out in order to validate the ethno-medicinal claims of plants belonging to this family.³

Most of commonly available plants of *Apiaceae* family notably have pharmacological effect on female reproductive system. Many of them have phyto estrogenic effect, galactogogue effect, and contraceptive effect ect. Here, we present a review on effect of most commonly available plants of *Apiaceae* on female reproductive system.

Furthermore, this review gathers and discusses the information described in Ayurvedic literature as well as in contemporary medicine regarding the effect of few important *Apiaceae* family plants on female reproductive system.

JEERAKA (*Cuminum cyminum*)

Jeeraka (Latin name – *Cuminum cyminum*, Family- *Apiaceae*) is one of the earliest cultivated herbs in Asia, Africa and Europe. In India it is extensively cultivated in northern Region. Cumin seeds are popular as culinary Spices and also used in folklore therapy since antiquity⁴.

Ayurvedic properties –

Rasa – Katu, tikta

Guna – laghu, ruksha

Veerya – ushna

Vipaka - katu

Doshagnata – Kaphavatahara

Karma– deepana, Grahi, pittakaraka, medya, pachaka, balya, ruchya, garbhashaya shodhaka, vrushya.

*Rogagnata - jwara, gulma, murcha, atisara, krumi*⁵

Chemical composition –

It contains 2.5-4% volatile oil, 10% fixed oil and protein. Volatile oil mainly consists of 30-50% cuminum aldehyde, small quantity of alpha pinene, beta pinene, phellandrene, cuminic alcohol, hydrated cuminaldehyde and hydrocuminine⁶.

Part used –seed.

Dosage –seed powder– 3-6gms⁷.

***Jeeraka*(*Cuminum cyminum*) women's disorders –**

According to Ayurveda *Jeeraka* is having *Garbhashaya shodhaka, garbhashaya shothahara, Stanya* and *vrushya* properties⁸.

It is indicated in *garbhini pittajanya vanti* (morning sicknesses in pregnant women) along with lemon juice.

As galactogouge, *Jeeraka* (*Cuminum cyminum*) powder is taken along with jaggery⁹.

Estrogenic/Anti osteoporotic Effect – Cumin is recognized as a phytoestrogen-rich plant containing estrogenic components, such as beta-sitosterol, stigmasterol, and the flavonoids luteolin and apigenin. Cumin may serve as a potential treatment option in estrogen-related conditions such as

postmenopausal osteoporosis¹⁰. In animals receiving a methanolic extract of cuminum, a significant reduction in urinary calcium excretion and augmentation of calcium content and mechanical strength of bone was found. Animals showed greater bone and ash densities and improved microvasculature with no adverse effect like body weight gain and weight of atrophic uterus¹¹.

Effect on Lactation- It is rich in iron and thus very good for lactating mothers as well as women who are undergoing menses or who are pregnant, since they are more in need of iron than others. Moreover, cumin is said to help ease and increase secretion of milk in lactating women due to presence of Thymol, which tends to increase secretions from glands, including milk which is a secretion from mammary glands. It is more beneficial if taken with honey. Cumin has remarkable amount of calcium (above 900 mg per 100 grams) which accounts to over 90% of our daily requirement of calcium. This calcium is an important constituent of milk and hence cumin is very good for lactating mothers¹².

Side effects - Cumin is safe in food amounts and seems to be safe for most adults in appropriate medicinal amounts. The side effects of cumin are not known¹³.

In Pregnancy- Not enough is known about use of cumin during pregnancy¹⁴.

Krishna Jeeraka (Carum carvi)

Krishna JEERAKA (Latin name – *Carum carvi*, Family- *Apiaceae*) is native to Europe and West Asia. It grows wild in Himachal Pradesh and is cultivated in the hills (as summer crop) and in plains of North India (as annual winter crop) and in the hills of south India¹⁵.

Its fruits are used as a spice for culinary purposes and also in cosmetics, beverage and pharmaceutical industries¹⁶.

Ayurvedic properties –

Rasa – *Katu*,

Guna – *laghu, ruksha*

Veerya – *ushna*

Vipaka - *katu*

Doshagnata – *Kaphavatahara*

Karma– *Deepana, rochana, Grahi, daurgandhyanashaka, vatanulomaka, balya, vrushya, garbhashaya shodhaka, stanya janana, hrudya, shothahara, jwarahara, chakshushya, medya.*

*Rogagnata – Mukhadaurgandya, aruchi, agnimandya, chardi, hrullasa, ajeerna, admana, udarashula, atisara, grahani, gulma, krimi, arsha, hriudaurbalya, shotha, prasootivikara, jeernajwara*¹⁷.

Chemical composition –

It contains 2.5 to 8% volatile oil, about 10% fixed oil, 15% of protein and resin. Volatile oil contains 45 to 65% of carvone, limonene, dihydrocarvone and traces of carvacrol¹⁸.

Part used – dried ripe fruits

Dosage – Fruit powder 1-3gms¹⁹

Krishna JEERAKA (Carum carvi) in women's health

According to Ayurveda it is considered as *Garbhashaya vishuddikara, stanyajanana* and as it is *vatanulomaka*, it is also indicated in *kashtartava*.

In the form of powder and decoction it can be used in the above elements²⁰.

Estrogenic/anti-osteoporotic activity: Cumin and caraway seeds are reported to be estrogenic. Potential effects of caraway on hormone and reproductive parameters of female ovariectomized rats are demonstrated due possibly to the presence of estrogenic isoflavonoids, luteolin and apigenin. An aqueous and an ethanolic extract of caraway seeds produced significant antifertility effect via modulation of follicle stimulating hormone (FSH) and leutinizing hormone (LH) levels, while the estrogen levels were increased. This was accompanied by an increase in the weight of ovary, uterus and also body weight. Caraway oil was effective in inhibiting tonic and phasic rhythmic contractions of isolated uterine preparations²¹.

Endocrine Activity: The effects of aqueous and ethanolic extract of the seeds of *Carum carvi*. (150, 200, 250 & 300mg/kg, p.o.) were investigated on hormone and reproductive parameter of female rat. Ethanolic and aqueous extracts of the seeds (150, 200, 250 & 300 mg/kg p.o.) were administered orally to female rat for 30 consecutive days exhibited its effect on ovarian endocrinology i.e. FSH, LH quantities. The gonadotropins follicle stimulating hormone (FSH) and luteinizing hormone (LH) were measured after 24 hours of the last dose of the drug. On treatment with drug, the FSH and LH level were significantly ($p < 0.05$) decreased and elevated level of estrogen only on treatment with ethanolic extract on drug. The estrus phase was blocked by treatment with both extract. Drugs also increase the ovaries weight, uterus and body weight, while the weight of uterine in immature rats increased. Potential effects of caraway on hormone and reproductive parameters were demonstrated possibly due to the presence of estrogenic isoflavonoids, luteolin and apigenin²².

Side effects – *Carum carvi* (Caraway), a herb commonly associated with galactagogue properties, is strongly contraindicated in pregnancy and breastfeeding due to its antispasmodic effects. Nevertheless, the use of caraway after C-section can speed the resumption of post-operative bowel motility²³.

It is also contraindicated in pregnancy as it may cause uterine contractions, miscarriages or premature labour²⁴.

shatapushpa (*Anethum graveolens*)

It is an important aromatic annual herb from the *Apiaceae* family. Seeds and leaves of this plant are the main parts that are being used. Dill is a medicinal herb, also widely used in the food industry for flavouring foods and beverages due to its pleasant spicy aroma²⁵

***Ayurvedic properties* –**

Rasa – *Katu*,

Guna – *laghu, ruksha*

Veerya – *ushna*

Vipaka - *katu*

Doshagnata – *Kaphavatahara*

Karma– *External* – *Vedanasthapana, shothahara, vrunaropna.*

Internal – *Kaphashamaka, rochana, deepana, pachana, anulomana, krimigna, hridfayottejaka, shothahara, mootrala, artavajana, stanyajanana, swedajanana, jwaragna, kushtagna and shukranashaka.*

Rogagnata –*External* – *oil* – *pakshaghata, sandigatavata, udarashula, karnashula, vatarakta.*

Internally – *vatavyadhi, aruchi, vama, krumi, hriddaurbalya, kasa, swasa, hikka, jwara, mutrakrichra, agnimandya, ajeerna, admana, rajorodha, yonishula, kashtartava, stanyakshaya, kushta, arsha, udavarta, bhagandhara, visarpa, netraroga*²⁶.

***Chemical composition* –**

It contains 2.4 to 4% volatile oil, about 20% fixed oil and proteins. The chief constituents of Volatile oil is aromatic liquid, known as carvone(43 to 63%) It also contains dihydrocarvone, D-limonene, phyllaquadrene and other terpenes²⁷.

Part used –fruits, leaf, seed oil and flower²⁸.

Dosage – Powder of fruits – 1-3gms, oil – 1-3drops, arka – 20-40ml²⁹.

shatapushpa (*Anethum graveolens*) in women's health

Dill seeds are one among the most promising culinary herbs used in the Indian tradition especially during childbirth. Dill seed essential oil is extracted from the dried seeds by steam distillation method. These magical little seeds and its essential oil are prescribed in Ayurvedic healing for treating dysentery, menses, diarrhea, inflammation and for mental disturbances³⁰.

Anethum graveolens or Shatapushpa used for treatment of ailments since ancient times. It is a very popular herb, known for its spice and essential oil. This plant belongs to *Apiaceae* family³¹.

Acharya Kashyapa had described it as nectar for women having gynaecological disorders. He has dedicated a separate chapter called “*Shatapushpa Shatavari Kalpadhyaya*” in his text “*Kashyapa Samhita*” to describe medicinal uses of *Shatapushpa*. In this chapter he has given many formulations used for the treatment of both male and female infertility³².

Female Reproductive System Effect -

The effects of *Anethum graveolens* L. (dill) extracts on the female reproductive system were studied in 54 Wistar female rats with regular estrous cycle in six groups. The experimental groups were fed with 0.045 g/kg and 0.45 g/kg of aqueous extract, 0.5 g/kg and 5 g/kg of ethanol extract for 10 days. The sham group was fed with solvent and the controls received no treatment. The oestrous cycle changes were determined by daily vaginal smear changes. At the beginning and at the end of the experiment blood samples were provided to determine the blood estradiol and progesterone concentration. The ovaries were prepared histologically and the volume of different follicles was estimated. A significant increase was observed in the duration of the oestrous cycle and in the diestrus phase and the progesterone concentration in high dose extract treatment. The stereological study did not reveal any significant changes in the volumes of ovaries, primary, secondary and graffian follicles. Dill can be used either as a regulatory agent of the menstrual cycle for women with irregular cycles or as an anti-fertility agent. More studies are needed to clarify the properties of this herb³³.

Nature's powerhouse of calcium:

Dill seed oil is a good source of calcium, dietary fiber, manganese, iron and magnesium. The presence of arginine strengthens bones, teeth and helps in the prevention of bone loss that occurs after menopause and even after some severe problems like rheumatoid arthritis. Few reliable sources even state that Dill seed oil is effective for treating hiccups due to its high calcium content.

Skin is the largest organ of the body and any medications used on the skin easily penetrates through the skin. The therapeutic properties of Dill seed essential oil when used topically, enters the skin and reaches the blood stream and heals the system naturally.

The best way to acquire the calcium and other energy nutrients of Dill seed oil is to add 3 drops of this oil to bathing water and massage your body with 6 drops of Dill oil blended with 3 ml of olive oil. This assists in supplying the essential calcium, iron, fibre, magnesium and other nutrients to the body.

Since it induces the secretion of certain enzymes and hormones, Dill seed oil is used to regulate the menstrual cycle, increase the quantity of breast milk, and prevent early ovulation by acting as a natural contraceptive. Dill seed oil is also used in perfumery and cosmetic industries³⁴.

Mishreya (Feniculum vulgare)

Mishreya (L N - Feniculum vulgare, F – Apiaceae) has been extensively used in traditional medicine for a wide range of ailments. Its stem, fruit, leaves, seeds, and whole plant itself are medicinally used in different forms in the treatment of a variety of diseased conditions³⁵.

A number of biological-pharmacological studies have been undertaken to evaluate the indigenous uses of *F. vulgare*. Few extracts of *F. vulgare* and isolated compounds have been evaluated for several activities, namely, antiaging, antiallergic, anticolic, antihirsutism, anti-inflammatory, antimicrobial and antiviral, antimutagenic, antinociceptive, antipyretic, antispasmodic, antistress, antithrombotic, anxiolytic, apoptotic, cardiovascular, chemomodulatory action, cytoprotection and antitumor, cytotoxicity, diuretic, estrogenic properties, expectorant, galactogenic, gastrointestinal effect, hepatoprotective, human liver cytochrome P450 3A4 inhibitory, hypoglycemic, hypolipidemic, memory-enhancing property, nootropic, and oculohypotensive activities³⁶.

Ayurvedic properties –

Rasa – Madhura, Katu, Tikta

Guna – Laghu, snigda

Veerya – Sheeta

Vipaka – Madhura

Doshagnata – Vata-pitta shamaka

Karma– medya, chakshusya, trushna nighrana, deepana, chardinighrana, pachana, anulomana, rechana, ahrudya, raktaprasadana, kaphanissaraka, mutrala, garbhaprada, yonishulahara, stanyajanana, vrushya, swedajanaka, dahaprashamana, balyavardhana, shukrakrut.

Rogagnata – mastiska dourbalya, drushti daurbalya, amatisara, pachana, agnimandya, ajirna, admana, vrana, udarashoola, pravahika, arsha, hridroga, kasa, shweasa, mutrakricha, mutraghata, stanyalpata, shukravridhi, twakvikara, jwara, daha, kshaya, netraroga, yonishula, malabaddata, vatajwara³⁷.

Chemical composition –

It contains 3 to 7% of volatile oil, about 20% each of protein and fixed oil. The chief active constituent of the volatile oil is a ketone, fenchone (about 20%) and a phenolic ether anethole (about 50%). The other constituents are phellandrene, limonene, methyl chavicol, anisic aldehyde, etc.

Fenchone is a colourless pungent liquid with aromatic odour. The anethole is sweet in odour and taste³⁸.

Part used – Fruit, oil, root, leaf

Dosage – powder – 3-6 gms, oil – 5-10 drops, root – 3-6gms, fruit extract – 20-40ml³⁹

Mishreya (Foeniculum vulgare) in women's health-

Antihirsutism Activity - Idiopathic hirsutism is defined as the occurrence of excessive male pattern hair growth in women who have a normal ovulatory menstrual cycle and normal levels of serum androgens. It may be a disorder of peripheral androgen metabolism. Traditionally, *Foeniculum vulgare* has been used as an estrogenic agent. It has been reputed to increase milk secretion, promote menstruation, facilitate birth, and increase libido. On considering above aspect, Javidnia and his research team evaluated the antihirsutism activity of ethanolic extract of *F. vulgare* seed against idiopathic hirsutism by preparing cream containing 1 and 2% of fennel extract. The efficacy of treatment with the cream containing 2% fennel is better than the cream containing 1% fennel and these two were more potent than placebo (control group). The mean values of hair diameter reduction were 7.8%, 18.3%, and -0.5% for patients receiving the creams containing 1%, 2%, and 0% (placebo), respectively⁴⁰.

Estrogenic Properties - *F. vulgare* has estrogen-like activity. In male rats, total concentration of protein was found to be significantly decreased in testes and in

vasa deferentia whereas increased in seminal vesicles and in prostate gland. On the other hand, simultaneous decrease in the activities of acid and alkaline phosphatase in all these regions (except that alkaline phosphatase was unchanged in vasa), due to the oral administration of acetone extract of *F. vulgare* fruit, was observed. In female rats oral administration of the extract for 10 days led to vaginal cornification and oestrus cycle ⁴¹.

Total concentration of nucleic acids and protein as well as the organ weights increased in both the tissues, namely, mammary glands and oviducts; due to the oral administration of acetone extract (50, 150, and 250 $\mu\text{g}/100\text{ g}$ body wt) of *F. vulgare* seeds⁴².

Fennel oil was reported to exhibit estrogenic activity, promote menstruation and alleviate the symptoms of female climacteric, and increase libido ⁴³.

Administration of fennel oil (25 and 50 $\mu\text{g}/\text{mL}$ final concentration in the organ bath) failed to exhibit any remarkable effect in uterine contraction. While 10, 20 and 40 $\mu\text{g}/\text{ml}$ concentration of fennel oil revealed significant inhibitory effect against prostaglandin E2. Fennel oil significantly reduces the frequency of uterine contraction induced by prostaglandin E2. Thus, the extracts of *F. vulgare* have strong estrogenic activity ⁴⁴.

Galactogenic Activity - *Foeniculum vulgare* has been used for millennia to increase milk secretion. Thus, *F. vulgare* belongs to galactagogue substance. Structural similarity of its main constituent, anethole, to dopamine seems to be responsible for galactogenic activity. Dopamine acts to inhibit the secretion of the milk-producing hormone, prolactin. Anethole might influence milk secretion by competing with dopamine at the appropriate receptor sites, thereby inhibiting the antisecretory action of dopamine on prolactin⁴⁵.

It was reported that anol (demethylated anethole) causes growth of the lobule-alveolar system in the mammary glands of immature female rabbits and induces menstruation in mice and other experimental animals. Anol also gave positive results in the Jadassohn nipple test, a test which involves the measurement of changes induced in the nipples of guinea pigs subjected to the cutaneous application of sex hormones. However, further research suggests that the actual pharmacologically active agents responsible for galactogenic activity are polymers of anethole, such as dianethole and photoanethole, rather than anol or anethole itself ⁴⁶.

The effect of fennel essential oil on uterine contraction as a model for dysmenorrhea, pharmacology and toxicology study⁴⁷.

Hingu (Ferula alliaceae)

Asafoetida is a resinous gum of a tall perennial herb, with robust carrot-shaped roots. It is dirty yellow in color with a pungent smell. It is used as a flavoring agent and forms a constituent of many spice mixtures.

Ayurvedic properties –

Rasa –Katu

Guna – Laghu

Veerya – Ushna

Vipaka – Katu

Doshagnata – Kapha-Vata shamaka

Karma– Vedanasthapana, uttejaka, anulomaka, shulaprashamana, Artavajanaka, vaajikarana, krumigna, deepana, paachana.

Rogagnata – Udarashula, agnimandya, vibandha, miutraghata, mutrakricchra, kasa, shwasa, hikka, kandu, krimi⁴⁸.

Chemical composition –

It contains resin (40-65%), gum (20-25%) and volatile oil (4 to20%). The resin of drug consists chiefly asaresinotannol in the free or combined form with ferulic acid. Free umbelliferone is absent in the drug. Ferulic acid on treatment with hydrochloric acid is converted in to umbellic acid, which loses water to form umbelliferone. Oil of tyhe asafoetida is obtained by steam distillation of the oleo- gum resin.the chief constituents of the oil are secondary butyl propanyl disulphide. Other constituents of oil are di and trisulphides, pinene and other terpenes. The specific odour of the drug is due to sulphur compounds of the formulae C₇H₁₄S₂, C₁₆H₂₀S₂and C₁₀H₁₈S₂⁴⁹.

Part used – oleo-gum-resin, leaf, stem, root.

Dosage – 0.12-0.5gm⁵⁰.

Hingu (Ferula alliaceaea) in women's health

The herb is considered useful in the treatment of several problems concerning women such as sterility, unwanted abortion, pre-mature labor, unusually painful, difficult and excessive menstruation and leucorrhoea. About 12 centigrams of gum fried in ghee mixed with 120 grams of goat's fresh milk

and a tablespoon of honey, should be given thrice daily for a month. It excites the secretion of progesterone hormone. Asafoetida is also useful for women after childbirth. Owing to its antifatulent and digestive properties, the herb can be taken with beneficial results during the post-delivery period. In southern India, the powder of the herb mixed with rice is given to women after delivery. Methanol extract of the resin, administered orally to Sprague–Dawley rats at a dose of 400 mg/kg daily for 10 days, prevented pregnancy in 80% of the rats. When administered as a polyvinylpyrrolidone 1:2 complex, 100% pregnancy inhibition was observed at this dose. Lower doses of the extract produced a marked reduction in the mean number of implantations. Significant activity was observed in the hexane and chloroform eluents of sulfur-containing extract in an immature rat bioassay, the methanol extract was devoid of any estrogenic activity⁵¹.

Yavani(Carum copticum)

Carum copticum commonly known as “ajawain” is cultivated in many regions of the world including Iran and India, states of Gujarat and Rajasthan. Traditionally, *Carum copticum* has been used in the past for various therapeutic effects including bloating, fatigue, diarrhoea, abdominal tumors, abdominal pain, respiratory distress and loss of appetite. It has other health benefits such as antifungal, antioxidant, antibacterial, antiparasitic and hypolipidemic effects⁵².

Ayurvedic properties –

Rasa –Katu, Tikta

Guna – Laghu, rukhsa, teekshna

Veerya – ushna

Vipaka – katu

Doshagnata – Vata-kapha shamaka

Karma– vedana sthapaka, shothahara, anulomana, jantugna, vishagna, rochana, krimigna, vatanulomana, hridayottejaka, mutrajanana, shukranashana, stranyanashana, garbhashayottejaka,swedajanana, sheetaprashamana.

*Rogagnata – Kaphavikara, shotha, charmaroga, vruschika damsha, vrana, admana, sheetapitta, aruchi, agnimandya, ajeerna, anaha, amavata, sandhishoola, udarashoola, gulma, pleeha, krimi,dantaroga, galashundika, arsha, hriddaourbalya, jeerna kasa, swasa, mutraghata, kashtartava, sootika jwar*⁵³.

Chemical composition –

It contains 2 to 4% of volatile oil, about 21% fat, 17% proteins and 25% carbohydrates. Traces of tannin, glycoside and steroidal substances have been reported. Volatile oil mainly contains thymol (35-60%), p-cymene (50-55%), terpinene(30-35%). Pinene, dipentenes, etc are other constituents of the oil. The flavour and taste of drug is due to thymol and volatile oil⁵⁴.

Part used – Fruit, leaf, root

Dosage – Powder – 3-6gms, oil – 1-3drops extract 30-120mg, arka – 20-40ml⁵⁵.

Yavani(Carum copticum) in women's health

Abortifacient and galactogogic action- *Trachyspermum ammi* is listed in 14 indigenous medicinal plants that were reported to have been used for abortion in some districts of Uttar Pradesh (India) in their survey conducted in 1987. Specifically, in the village of Kallipuschium, Lucknow district, 50 of the 75 pregnant women who were surveyed (of a total of 155 women in the fertile period) claimed to have used *T. ammi* seed for abortion. The herb was not 100% effective and so the possibility of causing congenital defects was of concern. There was a high risk of potential human fetotoxicity of ten plants including *T. ammi*, based on teratogenicity observed in rat foetuses⁵⁶.

The National Dairy Research Institute in India investigated the estrogenic content of some herbs (including *T. ammi*) that are traditionally used to increase milk yield in dairy cattle. *T. ammi* has also been traditionally used as a galactogogue in humans. The total phytoestrogen content of dry *T. ammi* seed was 473 ppm, which was the second highest in the list of eight herbs tested (total phytoestrogen contents 131-593 ppm)⁵⁷.

Mineraloherbal preparation containing seeds of *carum copticum*, leaves of *Cassia angustifolia* (Senna), fruits of *Terminalia chebula* (Himej) and *Embelia ribes* (Vidang), and roots of *Glycyrrhiza glabra* (Jethimadh) was administered to Sprague-Dawley rats (male and female) by oral route. This preparation reduced number of implantations in females who mated with male rats. However, it did not have significant effect on weight of testis, epididymis, and accessory glands, spermatogenesis, and mating rate in male rats ⁵⁸.

Discussion-

Postmenopausal women have an increased affinity towards cardiovascular diseases and osteoporosis.

The use of Hormone Replacement Therapy in managing menopausal and postmenopausal period is now questioned with increasing risks of cancer with long term HRT treatment. Less effectiveness and more side effects of other new therapeutics along with financial burden of management of osteoporosis related fractures, has led tremendous interest in herbal alternatives. The search for natural alternative to estrogen has led to a tremendous interest in phytoestrogens⁵⁹.

Phytoestrogens are trace biochemicals produced by plants that act like estrogens in animal cells and bodies. A number of epidemiological studies have reported a connection between high dietary intake of phytoestrogens and lower rates of certain cancers, cardiovascular problems, and menopausal symptoms⁶⁰.

Asian women have lower bone density and lower calcium intake than Caucasian women and yet have stronger bones and fewer osteoporotic fractures during menopause. They also have a lower risk of developing cancer and heart disease. A diet rich in phytoestrogens is believed to be a contributing factor, as evidenced by numerous studies^{61,62}.

Ayurveda, the oldest system of medicine, has provided many herbs which can be used in prevention of geriatric problems in women.

Plants of *Apiaceae* discussed here are rich with phytoestrogens which can be used as non hormonal alternative to treat and prevent post menopausal disorders. Moreover they are readily available in the most of Indian kitchens and can be used safely.

Bibliography –

1. <https://en.wikipedia.org/wiki/Apiaceae>
2. <https://www.studyandscore.com/studymaterial-detail/Apiaceae-umbelliferae-general-characters-distribution-important-plants-economic-importance-floral>
3. <https://www.sciencedirect.com/science/article/pii/S0926669017306258>
4. R. K. Johri, Pharmacogn. Rev 2011 Jan – June 5(9); 63
5. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;421
6. C.K. Kokate et al, Pharmacognosy, 37th edition; Nirali prakashana; Pune; 2007; 357

7. J.L.N.Shastrri, Illustrated Dravyaguna vignana vol II;2nd edition; Chaukhambha Orientalia Varanasi;2005;273
8. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;421
9. Karnataka knowledge commission, dept of Ayush, Dravyakosha – A compendium of medicinal plants of Tumkur And Shimoga District, Vol I, I edition, Adhimaani publications, rajaji nagar, Bengaluru, 2012;P no 197
10. www.readperiodicals.com
11. R. K. Johri, Pharmacognosy Reviews, 2011 Jan – June 5(9);63-72
12. www.seedguides.info>cumin
13. www.seedguides.info>cumin
14. www.seedguides.info>cumin
15. <http://www.la-medicca.com/raw-herbs-Carum-carvi.html>
16. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/carum-carvi>
17. K V Billore et al, Data base on medicinal plants used in Ayurveda Vol VI, New Delhi, documentation and publication division ;CCRAS; 2004;88
18. C.K. Kokate et al, Pharmacognosy, 37th edition; Nirali prakashana; Pune; 2007; 326
19. K V Billore et al, Data base on medicinal plants used in Ayurveda Vol VI, New Delhi, documentation and publication division ;CCRAS; 2004;87
20. <http://www.jocpr.com/articles/carum-carvian-important-medicinal-plant.pdf>
21. T Malini; G Vanithakumari, Indian J. Exp. Biol., 1987, 25, 442-444.
22. Thakur S, Bawara B, Dubey A, Nandini D, Chauhan NS and Saraf DK. Effect of Carum carvi and Curcuma longa on hormonal and reproductive parameter of female rats. International Journal of Phytomedicine. 2009; 1:31-38.
23. Yosef et al. 2014
Yosefi SS, Sadeghpour O, Sohrabvand F, Atarod Z, Askarfarashah M, At eni TR, Yekta NH. 2014. Effectiveness of Carum carvi on early return of bowel motility after caesarean section. Eur J Exp Biol. 4:258–262.

24. Shinde et al. 2012 Shinde P, Patil P, Bairagi V.2012. Herbs in pregnancy and lactation: a review appraisal. Int J Pharm Sci Res. 3:3001–3006.
25. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/anethum-graveolens>
26. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;358
27. C.K. Kokate et al, Pharmacognosy, 37th edition; Nirali prakashana; Pune; 2007; **332**
28. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;357
29. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;358
30. <http://ayurvedicoils.com/tag/anethum-sowa>
31. <https://www.planetayurveda.com/library/shatapushpa-anethum-graveolens/>
32. [http://ijapc.com/volume4-third-issue/v4-i3-\(v4i2-46\)-p-44-51.pdf](http://ijapc.com/volume4-third-issue/v4-i3-(v4i2-46)-p-44-51.pdf)
33. <https://pdfs.semanticscholar.org/01de/5e1b22694d6f92ebfa2f3b5fe9c309703742.pdf>
34. <http://ayurvedicoils.com/tag/anethum-sowa>
35. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4137549/>
36. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4137549/>
37. K V Billore et al. Data base on medicinal plants used in Ayurveda Vol VII, New Delhi, documentation and publication division ;CCRAS; 2005;284
38. C.K. Kokate et al, Pharmacognosy, 37th edition; Nirali prakashana; Pune; 2007; 335
39. K V Billore et al. Data base on medicinal plants used in Ayurveda Vol VII, New Delhi, documentation and publication division ;CCRAS; 2005;284
40. Javidnia K, Dastgheib L, Samani SM, Nasiri A. Antihirsutism activity of Fennel (fruits of *Foeniculum vulgare*) extract: a double-blind placebo controlled study. *Phytomedicine*. 2003;10(6-7):455–458.

41. Effect of *Foeniculum vulgare* Mill. seed extract on the genital organs of male and female rats. - Malini T, Vanithakumari G, Megala N, Anusya S, Devi K, Elango V Indian J Physiol Pharmacol. 1985 Jan-Mar; 29(1):21-6
42. Effect of *foeniculum vulgare* seed extract on mammary glands and oviducts of ovariectomised rats. Devi K, Vanithakumari G, Anusya S, Mekala N, Malini T, Elango V Anc Sci Life. 1985 Oct; 5(2):129-32
43. Albert-Puleo M. Fennel and anise as estrogenic agents. *Journal of Ethnopharmacology*. 1980;2(4):337–344.
44. The effect of fennel essential oil on uterine contraction as a model for dysmenorrhea, pharmacology and toxicology study. Ostad SN, Soodi M, Shariffzadeh M, Khorshidi N, Marzban H J Ethnopharmacol. 2001 Aug; 76(3):299-304.
45. Albert-Puleo M. Fennel and anise as estrogenic agents. *Journal of Ethnopharmacology*. 1980;2(4):337–344.
46. Medicinal properties of *Foeniculum vulgare* Mill. in traditional Iranian medicine and modern phytotherapy; Rahimi R, Ardekani M; Chin J Integr Med. 2013 Jan; 19(1):73-9.
47. Ostad SN, Soodi M, Shariffzadeh M, Khorshidi N, Marzban H J Ethnopharmacol. 2001 Aug; 76(3):299-304.
48. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;128
49. C.K. Kokate et al, Pharmacognosy, 37th edition; Nirali prakashana; Pune; 2007; 403
50. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;128
51. Keshr G, Lakshmi V, Singh MM, Kamboj VP. Post-coital antifertility activity of *Ferula asafoetida* extract in female rats. *Pharmac Biol*. 1999;37:273–8.

52. <https://www.semanticscholar.org/paper/Carum-copticum-L.%3A-A-Herbal-Medicine-with-Variou-Boskabady-Alitaneh/a4243201ca74b5b3e2a8af6f6cf25f6ad86c7e55>
53. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;498
54. C.K. Kokate et al, Pharmacognosy, 37th edition; Nirali prakashana; Pune; 2007; 332
55. Prof G. S. Levekar et al. Data base on medicinal plants used in Ayurveda Vol VIII, New Delhi, documentation and publication division ;CCRAS; 2007;49
56. Nath D, Sethi N, Srivastav S, Jain AK, Srivastava R. Survey on indigenous medicinal plants used for abortion in some districts of Uttar Pradesh. *Fitoterapia* 1997;68:223-5. †
57. Kaur H. Estrogenic activity of some herbal galactogogue constituents. *Indian J Anim Nutr* 1998;15:232-4. †
58. S. R. Srivastava, S. Kesarwani, G. Keshri, and M. M. Singh, "Evaluation of contraceptive activity of a mineralo-herbal preparation in Sprague-Dawley rats," *Contraception*, vol. 72, no. 6, pp. 454–458, 2005.
59. https://www.researchgate.net/publication/220390975_Phytoestrogen_-_A_boon_for_ageing_women
60. <https://www.uspharmacist.com/article/focus-on-phytoestrogens>
61. Setchell K, Lydeking-Olsen E, "Dietary phytoestrogens and their effect on bone: evidence from in vitro and in vivo, human observational and dietary intervention studies," *Am J Clin Nutr* 2003; 78(suppl):593S–609S
62. Cassidy A, Albertazzi P, Nielsen L et al., "Critical review of health effects of soya bean phyto-oestrogens in post-menopausal women," *Proc Nutr Soc* 2006; 65(1): 76-92.

