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REVIEW ARTICLE

Therapeutic Benefits of *Foeniculum vulgare and Prunus domestica* in Various Stages of Female Life Cycle: A Review

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Abstract

Food Components with nutraceutical potential have major role in women's fitness and over all health as well as wellbeing. Such food components with therapeutic potential have factually been used as beginning point in development of certain drugs and pharmaceutical products which have contributed to our health care system since ages. Such plant based remedies include herbal medicinal supplements, some detox products and various foods with nutraceutical benefits and they find their application in treatment of various Women related complications like infections caused by yeast, infection of urinary tract, hot flushes, menopausal and post menopausal issues, bacterial vaginosis, PCOS as well as certain non-communicable diseases. Non-communicable disease result into both disability among women worldwide. *Foeniculum vulgare & Prunus domestica* commonly known as fennel and prune have been traditionally known for their nutraceutical potential. *Foeniculum vulgare* i.e. Fennel seeds have been traditionally known for being a good source of essential oils, certain vital minerals and vitamins as well as certain bioactive components isolated from these seeds have proved to be beneficial for Women's health. Globally sweet – flavoured *Foeniculum vulgare* seeds are very popular and have great application in therapeutic field. Another Indigenous food researched and reviewed on is *Prunus domestica* and it has proved to be a non pharmacological supplement which provides relief from constipation to older females. It is generally recognized as a source of fibre and is less well-known as a natural source full of sorbitol, malic acid, and natural antioxidants which act as deterrent against pathogenic organisms. Such food components with no side effects can be used for development of certain ready to eat products with nutraceutical potential and open new doorways for entrepreneurship development.

Keywords: *Foeniculum vulgare*, Health benefits, Nutraceutical component, *Prunus domestica.*

Introduction

Women is one of the most important creations of god and play a multi role as well as focus variety of problems related to health care which require special attention. In the entire life cycle the female experiences several gynaecological issues like infertility, pregnancy, contraception, pelvic pain, vaginal itching, vaginal discharge, breast pain etc required to be addressed for ensuring better health (Kour, 2016). Besides all these issues other complications including chronic degenerative diseases ie NCD'S are upcoming as major health concern not only for males but also for females both in India as well as globally, however till date the efforts for improving the health of women have mainly focused on women's sexual and reproductive health (Peter *et al*., 2016). In spite of advances in healthcare still the therapeutic healing based on allopathy medicine proves to be too expensive as well as disturbing. It is not affordable hence not inside the reach of poor, considering the other factors certain risk of side effects because of the curative treatment adopted for fitness addressing to various women related issues like menstrual disturbances as well as menopause there is a need to explore other alternative sources. Hence here we are presenting review on nutraceutical properties of *Foeniculum vulgare* and *Prunus domestica* which through several researches have proved to be beneficial in improving health of females.

Objectives

1. To compile a detail of overview on women's health for sustainable development.
2. To investigate vital role of various nutraceutical component present in Fennel or *Foeniculum vulgare* and Prunes or *Prunus domestica* in maintenance of women's health.

In the last few centuries various aspects of Women's health have improved but still there are certain unmet needs. Some of the major aspects of health include reproductive health, infections, nutritional parameters and different social parameters have further resulted in emerging epidemic of chronic non communicable disease hence a

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life cycle approach towards sustenance of women's health is important (Langer *et al.*, 2015).

Several researches have emphasized that incorporation of certain nutraceutical components in diet on daily basis can be used as remedies both for reproductive health issues as well as other complications like Polycystic Ovarian Syndromes, delayed labor, low breast milk production, bone health, infertility and certain infections. These natural supplements don't have any adverse effects and can be used to address the issue of Non Communicable Diseases too. Considering the present scenario and changed lifestyle the allopathic system of medicines and their associated side effects have been a matter of concern thus herbal supplements are gaining popularity and becoming a part of daily life. Positive results attained by regular consumption of these herbal supplements have proved to be better option against allopathic medicines which besides having side effects are also not pocket friendly (Raja, 2015).

Henceforth health issues effecting females during various stages of life cycle like adolescence, pregnancy, lactation, menopause and post menopause can be better addressed by adopting healthy life style and incorporating such herbs in diet daily. Problem concerned with women's health include dysmenorrhoea, premenstrual syndrome, hot flushes, night sweats, anxiety, irritability, vaginal dryness, vaginal atrophy besides degenerative diseases (Verma *et al.*, 2018). Addressing them through some commonly available foods can be a sustainable approach and can also promote development of several entrepreneurial ventures in near future hence nutraceutical properties of *Foeniculum vulgare* or fennel seed and *Prunus domestica* or Prune have been explored and presented in form of reviews.

Nutritional Composition and Health Benefits of *Foeniculum vulgare* or Fennel Seeds

Fennel seed being a famous plant with beneficial medicinal as well as culinary application. Fruits of fennel is seeds are often used as flavouring agent in various preparations. Certain Phyto constituents present in it are aromatic derivatives and aromatic compounds with certain physiochemical properties which further help in inhibiting the growth of certain bacteria (Parsaeyan, 2016). Historically fennel seeds have been associated with courage, strength and longevity mainly because of their medicinal value and number of health benefits because of the presence of several nutrients, compounds, antioxidants, dietary fiber etc. These seeds possess several flavonoids like kaempferol and quercetin having powerful antioxidant properties helpful in scavenging free radicals and ensuring protection against several cancers, aging, neurological diseases too. Certain volatile essential oil known for their carminative, anti flatulence, antioxidant properties including anethole, pinene, chavicol etc. (Mahaddese, 2019).

Fennel seeds are important source of minerals which play an important role in production and synthesis of RBCs like copper, iron, magnesium etc and also act as a co-factor in number of enzymes systems. Potassium is another mineral that helps controlling heart rate and blood pressure another mineral of importance is manganese which acts as a cofactor for an antioxidant enzyme, superoxide dismutase. Zinc in other micronutrients found in these seeds further facilitates in maintaining body defense system immunity. Other vital nutrient present in these seeds include B-complex vitamins and some fat soluble vitamins. The fibre present in seeds too helps in reducing re-absorption of cholesterol and prevents heart complications commonly observed in middle aged women. These seeds also help in maintaining blood pressure and keep the heart rate balanced as they are rich in potassium they also facilitate in maintaining blood flow during menstrual periods. These seeds also help in resolving certain issues like vaginal atrophy, hirsutism commonly observed by menopausal females without posing any side effect on bone density as well as body mass index of menopause women. Thus these digestive, carminative, and antioxidant rich properties promotes wellbeing and several researches have highlighted that fennel is a valuable medicinal plant with wide application in addressing various ailments associated with women's health (Mahaddese, 2019).

One major active ingredient present in fennel is anethole and it is a strong anti bacterial and antioxidant agent. Terpenes act as building blocks of certain steroids and are marked with several health properties. This chemical further participates in number of biochemical pathways besides playing an important role in influencing female health. It can mimic *estrogen* ie the female sex hormone and has important implication in maintaining the metabolic system too. This chemical also influences the role of *prolactin* hormone : a hormone playing an important role in breast feeding females by promoting milk production. Fennel besides being good source of certain minerals and vitamins also contain antioxidant enzyme ie superoxide dismutase (SOD) (Badgujar *et al.*, 2014)

Fennel has an important place since ancient times particularly in life of female during lactation period as it increases the milk production and it was recommended by Hippocrates of ancient Greece to lactating women. Beside mimicking *esterogen and prolactin*, anethole can mimic dopamine too as its chemical size is similar to it. The role of dopamine is to block *prolactin* thus by competing with dopamine for dopamine receptors anethole blocks the inhibitory action on prolactin thereby

facilitating the process of lactation (Honarvar *et al.*, 2013). Fennel have proved to be beneficial in subsiding painful menstruation or Dysmenorrhea symptoms usually suffered by females which last for 72 hours. Fennel seeds provide relief from such symptoms during menstruation. Forty tested women reported relief from symptoms like nausea and feeling weak as well as reduced cycle on supplementing with fennel capsule prior to onset of menstruation (Ghodsi and Asltoghiri, 2014).

Research done by Arzoo and Parle, 2007 reported that *foeniculum vulgare* oil seriously reduced intensity of problem faced during menstruation. Some nutraceutical properties of fennel oil are beneficial in management of lactation too by promoting milk production. It is also helpful in subsiding various syndromes associated with menstrual and premenstrual period including amenorrhoea and polycystic ovary etc. Effectiveness of blend containing fennel extract mixed with vitamin E was evaluated by Nasehi *et al.*, 2013. The mixture proved to be more effective than ibuprofen which is a commonly consumed drug with non steroidal in nature with anti inflammatory properties and usually used by females during menstruation. The results of the research highlighted that a reduction in pain intensity was reported by 68 females on supplementing with fennel/ vita- E elixir which sustained for longer duration and was faster in action in comparison to ibuprofen.

Females also suffer with premenstrual syndrome characterized by a several physical and emotional disturbances. This problem is usually reciprocated as irritability, food craving, fatigue and sometimes acne and fennel helps in subsiding the severity of these symptoms (Delaram *et al.*, 2013). Another major landmark in a female's lifecycle is menopause identified by functional impotency of ovaries and confirmed if there is no menstruation for more an year. Certain vaginal, urinary symptoms and other psychological issues are characteristic of this period. It is also associated with certain complications like osteoporosis and heart disease. Hormone Replacement Therapy is a recommended pharmaceutical treatment recommended for it. The associated side effects of this therapy are major point of concern hence recommended approach involves utilization of natural or herbal remedies and fennel is one such ingredient if included daily in diet can ensure relief from certain symptoms (Rahimikian *et al.*, 2017)

Calcium, magnesium and phosphorous are certain minerals along with vitamin K present in fennel and all are involved in the process of bone strengthening, past fennel researches have proved prevention of bone loss in osteoporotic animals thus proving the role of fennel in improving the bone mineral density by enhancing mineral deposition which is major health issue in menopausal females (Kim *et al.*, 2012).

Besides the complication associated with life cycle the process of nutrition transition has also resulted in number of health complication including Diabetes, cardiovascular diseases etc effecting females due to the dual burden associated with the desire of attaining work life balance. Extract of Fennel seeds have proved to be beneficial particularly in management of Diabetes Mellitus (DM) which is presently leading reason of death, illness, economic loss globally. Glycemic index of fennel is quiet low may be because of the powerful antioxidants present in it. Certain other nutrients like vitamin C which is also an effective antioxidant and helps in combating ROS resulting into low blood sugar levels. The beta carotene present in these seeds is also linked to low blood sugar and cholesterol lowering properties. Regular use of fennel facilitates in improving hyperglycaemia, hyper chlosterolemia and helps in management of glycated haemoglobin (HbA1c) (Dongare *et al.*, 2012). *Foeniculum vulgare* extract was orally administered in amount of 50, 75, 100mg/kg for 30 days and its effect on blood glucose, cholesterol, triglyceride, LDL cholesterol, HDL-cholesterol was evaluated. The results of research highlighted that oral supplementation exhibited beneficial effects on lipid profile as well as certain enzyme systems like aminotransferases there by suggesting practical use of fennel for further evaluation in drug development can be done (Luaibi *et al.*, 2017).

Fibers present in fennel helps in reducing LDL-cholesterol and triglycerides in blood and helps in increasing HDL-cholesterol, fiber also binds the bile salts and further helps in prevention of re - absorption of LDL-cholesterol. The phytonutrients and the phenolic compounds like anethole and vitamin C and folic acid also help in preventing lipid peroxidation and enhancing HDL-cholesterol besides activating antioxidant enzymes eg superoxide dismutase (SOD) and catalase (CAT) (Choi and Hwang, 2004). Teas prepared by incorporating fennel have traditionally used as remedy for relief against arterial tension thus reducing the risk of coronary heart diseases, stroke and heart attack. Bioactive component anethole helps in reduction of blood pressure as it acts as diuretic and helps in maintenance of heart and respiratory rate (Ghani and Amin, 1988). Anethole also possess anti-platelet properties, disrupting the formation of blood clots (or thrombus). It is a potent vaso-relaxant, reduced platelet aggregation without any side effects (such as prohemorragic and bleeding times) often seen with blood thiner drugs like aspirin (acetylsalicylic acid), and alcohol induced gastric ulcers (Tognolini *et al.*, 2007). In management of liver and kidney diseases too the phytonutrients present in fennel play protective roles from

oxidative stress and this has proved to be quiet effective. Phytonutriens like beta Mycene and Limonene have properties related to protection and promotion of hepatic health as reported in animals who were induced with drug and the kidney damage because of strong free radical scavenging properties. One more component ie *5-Methoxypsoralen* being a phytochemical have been reported to inhibit human liver cytochrome P450-3A4 (CPY3A4). This cytochrome helps in break down of foreign organic molecules and in deactivating drugs while activating others. In smaller dose it generates less stress and has lesser side effects (Subehan *et al.,* 2007). Fennel seed is important source of certain secondary metabolites, which is beneficial as fragrances, pharmaceuticals, flavours, agrochemicals, colours, bio-pesticides. Researches highlighted both pharmacological and therapeutic effects of *Foeniculum vulgare* have been promising source of drugs because of its safety and effectiveness (Sadeghpour *et al.,* 2015). There is a positive impact of fennel seed extract on the amount of oxidative factors in mice (Female) hence it can be used for novel medicine which can be used for treatment of infertility too (Kooti *et al.,* 2014). Thus the bioactive compounds present in fennel seeds with pharmacological properties like they are antimicrobial, antiviral, anti-inflammatory, anti mutagenic, antipyretic, antispasmodic as well as antithrombotic in nature (Bukhari *et al.,* 2014). And these medicinal properties have ensured usage of fennel in several ayurvedic formulations and in treatment of ailments associated with digestive, endocrine and respiratory system (Akbar, 2018).

Nutritional Composition and Health Benefits of *Prunus domestica* or Prunes

Recently plums have been popular because of their health promoting properties and promising anti-inflammatory, antioxidant as well as memory improving capabilities. Prunes are concentrated source of energy, fibres certain minerals and vitamins besides this the pulp of the plum fruit can pureed and mixed with several other ingredients in order to improve its sensory and physicochemical attributes. Plums are the excellent source of antioxidants and minerals such as calcium, magnesium, iron and potassium (Singh *et al.,* 2019). The amount of fat is also low and they contain important nutrients such as carbohydrate, minerals and beneficial vitamins. Plum products have many medicinal values. It's consumption is very beneficial because it is very useful for various infectious diseases measles, blood circulation problems, also digestive problems as well as diabetes, cancer and obesity too (Li, 2008). In cardiovascular problems it is very beneficial. Gastrointestinal tract motility is increased by it's consumption thus proving its laxative effect. Consumption of 100g of prune are sufficient for daily requirements of boron. It is very useful for diabetic patients because plum consumption doesn't faster increase blood glucose (Stacewicz *et al.,* 2001).

The dried version of plums is prunes and for producing them plums are dried at 85-90 degrees centigrade for approximately 18h. Prunes are known for their laxative effects besides having antioxidant properties and also a rich source of magnesium, niacin, potassium, vitamin A, vitamin B6, vitamin C, iron and calcium. Hydroxyl phenyl satin a chemical present in prune helps in stimulation of soft muscles of the large intestine which further helps in production of efficient bowel movement. Thus it can be interpreted that dried plums have laxative and constipation relieving effect. It is also reported that they are rich in fibre and carbohydrates called sorbitol which also facilitates in relieving from constipation a commonly reported complication in elderly females (Arjmandi *et al.,* 2004).

Dried plums are potent source of certain bioactive components like phenols and flavonoids these compounds have proved to be more impressive in adjusting bone mass in ovarian hormone insufficient female subjects. This further facilitates in management of certain complications like osteoporosis and bone turnover dried prunes importantly enhance level of growth factor-I (IGF-I) bone - specific alkaline - phosphatise activity there by posing positive effects on bone mineral density in postmenopausal women (Lever *et al.,* 2018). According to Nakatani *et al.,* 2000; Walle *et al.,* 2004 high levels of phenolic compounds mainly anthocyanins have been associated with certain health benefits like improving the bone health, memory, cognitive capabilities antioxidant and anti-inflammatory properties as well as ensuring relief from constipation.

Prunes help in maintaining healthy bowel functions but their potential mechanisms not clear and further researches are required to study their effect on gastrointestinal (GI). Association of prunes with whole gut transit time that is WGTT, gut micro-biota as well as SCFA ie short-chain fatty acids in healthy adult females was evaluated. The research reported that prunes have no effect on SCFA as well as on the pH of stool. Hence it can be interpreted that in every person with irregular stool habits can be benefited with regular consumption of prunes as it facilitates in increasing frequency and also stool weight (Arjmandi *et al.,* 2017).

Plum fruits are traditionally used as a jams and other food products, these products have a longer shelf life. *Prunus domestica* used as a functional food and for important effects on human health because prune have phenolic content and high antioxidant activity. Specially, Fruits are natural source of antioxidant compounds like

flavonolignans, tannin, phenolic acids and also highest oxygen radical absorbance capacity (ORAC) value. Dried plum can be considered as the most important functional foods and also useful bcause of its bone-modulating effects. Muhlbaver *et al.,* 2003 reported that dried plum/ prune have good capacity to prevent or improve osteoporosis by reducing bone resorption. Finding of this study reflected that prune/ dried plum have positive effects on bones and also help for making bones strong (Deyhim, 2005; Bu, 2007).

Interventions performed by incorporating dried prunes (*Prunes domestica*) have proved to be efficacious in prevention and reversal of bone mass as well as avoiding structural loss in ovariectomized rat a model of osteoporosis in orthopaedic post menopausal women. The findings of research have highlighted promising as well as efficacious functional food therapy by incorporating them as it facilitated in improving facilitative bone mass among post menopausal women there by reflecting a bone protective effects (Ahmed *et al.,* 2010).

All health promoting properties of plum's are mainly attributed to its antioxidant potential and high phenolic content (Yu *et al.,* 2009; Franklin *et al.,* 2006). Smith *et al.,* 2014 studied long term effects of dried plum or prunes on certain biomarkers of bone metabolism and altered gene expression further more the regulators of osteoblast and osteoclast differentiation and osteoclast activity was studied for approximately 6 weeks. It was observed that supplementation of dried plum suppressed the bone turnover with no effects on the indices of bone formation at endocortical surface. Other studies also proved same effect as dried plum supplementation initially suppressed the turnover of bone and had positive effect on the bone mass as well as bone structure hence it proved to be effective in enhancing bone calcium retention approximately by 20% (Pawlowski *et al.,* 2014)

Secondary researches have highlighted that fruits and vegetables possess a reducing effect on blood pressure and they form a major component of DASH diet i.e. Dietary Approaches to Stop Hypertension. Fruits serve as store houses of antioxidants whose regular supply ensure good health and help in lowering systolic and diastolic blood pressure. Remarkable reduction in blood pressure has been reported by particular dose of prunes every group and controls ($p<0.05$). Provide the double dose of plum/ prunes, so only SBP that is systolic blood pressure was decrease remarkable ($p<0.05$). In control group had remarkable induced serum high density lipo - protein whereas in test groups had remarkable decrease serum cholesterol and LDL that is low density lipo – protein ($p<0.05$) (Monsefi, 2013).

Approximately 32 pregnant mice were supplemented with *Prunes domestica* L. liquid and it's effect on foetuses and their neonatal - skeletal system was studied supplementation was done with plum hydro - alcoholic solution at specially gestational days, one to eighteen and through total gestational period for ten days postpartum supplementation was continued till thirty days. Supplementation period was followed by measurement of bone calcium amount, serum calcium, alkaline phosphatise activity and magnesium content. Skeletal systems of their foetuses/ neonates were cleaned with alizarin red and also alcian blue. And the measured the tibia, femur and ossification centre. Results of this research highlighted that treated with plum extracts that have crown-rump length of newborn mice (babies), (4.61 ± 0.25 mm) was highest compared with control group that is ($p = 0.001$ and 4.48 ± 0.31 mm). By treated with plum extract mothers femur osteogenesis index of new born baby also increased compared with control group that is (0.87 ± 0.09) and (0.81 ± 0.06, $p = 0.007$). Research shows that pregnant mother treated with plum juice had new–born mice and also foetuses with increase osteogenesis index than control groups (Monsefi *et al.,* 2013)

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