Health Benefits of Fennel

Not very familiar with this bulbous seasonal veggie? Here's what to know.

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Fennel (Foeniculum vulgare) may be less familiar than broccoli or zucchini, but this bulbous fall vegetable and its seeds deserve to be part of your regular rotation. Fennel boasts nutrients such as fiber, potassium, and vitamin C.

A member of the carrot family, this slightly sweet vegetable may support brain health, digestive health, and more. Here is more about fennel's nutrients and potential health benefits, what it tastes like, and how to incorporate it into raw and cooked dishes.

Dietary supplements are minimally regulated by the FDA and may or may not be suitable for you. The effects of supplements vary from person to person and depend on many variables, including type, dosage, frequency of use, and interactions with current medications. Please speak with your healthcare provider or pharmacist before starting any supplements.

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Benefits of Fennel

Fennel boasts health-protective nutrients and may improve the health of your skin, bones, digestive system, and more.

Abundant in Health-Protective Nutrients

Studies show that fennel contains health-protective antioxidants and valuable antimicrobial, antiviral, anti-fungal, and anti-inflammatory compounds.[1] It's no surprise, then, that fennel has long been used as a medicinal plant for a wide range of issues related to digestive, endocrine, reproductive, and respiratory systems and as a milk stimulant for lactating parents.[2]

Alleviates Symptoms of Menopause

For people going through menopause, the health benefits of fennel are primarily tied to its oil. A 2019 paper reviewed the positive effects of fennel oil in the management of painful menstruation, premenstrual syndrome, missing periods, menopause, lactation, and polycystic ovary syndrome.[3]

The paper cites one study in which postmenopausal women taking 100 milligrams of fennel oil twice daily for eight weeks improved their scores on a menopause rating scale compared with women on a sunflower oil placebo. They experienced a reduction in symptoms such as hot flashes, insomnia, and night sweats.

Consult with a healthcare provider to determine if you can benefit from fennel oil, which formulation to buy, and how to use it—as well as to monitor any potential interactions, allergic reactions, or other side effects. This is especially important if you're pregnant or trying to conceive. Fennel supplements may also interfere with the effectiveness of birth control pills.

Eases Menstrual Cramps

Fennel may soothe menstrual cramps, which can be helpful if your cramps keep you from attending school or work or participating in your daily activities.[4]

This might be because fennel may decrease the number of prostaglandins in your body.[3] Prostaglandins are chemicals that help your uterine muscles contract and shed the tissue that lines the inside of your uterus (also called the endometrium). People who have excessive prostaglandins may experience more frequent, painful contractions than normal.[5]

Additionally, fennel has nitrites, which aid blood flow.[6] Therefore, nitrites may also help the endometrium shed more easily and quickly than normal.

Helps Ease Pain

A 2020 study looked at the effect of fennel on people with knee osteoarthritis. Sixty-six patients were randomly assigned to receive either a capsule containing powdered fennel extract, or a placebo, daily for two weeks. The fennel group experienced a reduction in pain and stiffness that was higher than in the control group.[7]

Improves Bone Health

Fennel is also an excellent source of calcium, which keeps your bones healthy. Calcium is vital for bone strength. A lack of calcium can increase your risk of developing osteoporosis and bone fractures.[8]

May Aid Weight Management

One of the organic compounds found in fennel—anethole—may naturally suppress appetite, which can be beneficial if you're trying to manage your weight.

In a study published in 2015, researchers gave nine women three different teas, one of which included fennel.[9] After the participants consumed the teas, the researchers presented them with a buffet and analyzed the food the participants consumed. All in all, the researchers found that after drinking fennel tea, participants reported less hunger and more feelings of being full, compared to those who drank placebo tea.

However, it is important to remember that the sample size of that study is small, and the supposed appetite-suppressing qualities of fennel may not be true for every person.

May Benefit Digestion

The seeds from fennel plants are commonly used as a type of spice to season food. Medicinally, fennel seeds have also been used to treat bloating

and gas via a tea made from a small spoonful of the seeds and hot water, steeped for 20 minutes, and sipped a half hour after a meal.

This may work because fennel and its seeds offer fiber, which supports digestion.[10]

May Promote Healthy Skin

Fennel packs vitamin C, an antioxidant that reduces cell damage caused by free radicals, which are harmful substances partly produced by ultraviolet (UV) exposure. Free radicals may contribute to skin cancer and premature aging.[11]

Although more research is needed, foods that pack antioxidants (like fennel) might help reduce the damage from UV exposure.[12] Either way, you should also limit your UV exposure and wear SPF of at least 30.[13]

May Protect Against Chronic Diseases

The vitamins and minerals and compounds found in fennel may help prevent certain chronic diseases, like cardiovascular diseases and cancer.[10]

For instance, fennel packs fiber. Fiber is one nutrient that can lower your risk of heart disease.[10]

Also, the anethole found in fennel might help lower the risk of developing or furthering the growth of certain cancers. In a study published in 2021, researchers found that anethole helps trigger apoptosis.[14] Apoptosis is programmed cell death, an essential process to prevent the development and spread of cancer cells.

Promotes Brain Health

Some research has pointed to fennel helping prevent degenerative diseases, like Alzheimer's disease.

In a 2017 study, researchers studied the antioxidants found in the essential oils (EOs) and aqueous extracts of four herbs, including fennel.[15] After evaluating the herbs, the researchers found that they may help reduce oxidative stress, which damages your cells.

Based on their findings, the researchers concluded that fennel is among the herbs that can help reduce cognitive decline.

Reduces Risk of Anemia

Iron is one of the minerals found in fennel. Iron is an important component of hemoglobin, which is a protein that transports oxygen from your lungs to different parts of your body.[16]

People who have low levels of iron may develop anemia, a condition that can cause weakness and fatigue, among other symptoms. Because of the iron content, fennel can help replenish some of the iron in your body if you have—or are trying to avoid—a deficiency.[17]

Supports Eye Health

Fennel packs antioxidants that fight eye diseases, like macular degeneration. For example, per a study published in 2013, vitamin C—found in fennel—helps support your eyes. Vitamin C even helps regenerate other antioxidants that support eye health, such as vitamin E.[18]

Nutrition of Fennel

According to the United States Department of Agriculture, one cup of raw fennel slices has the following nutritional profile:[19]

Calories: 27 calories
Fat: 0.17g
Sodium: 45.2mg
Carbohydrates: 6.35g
Fiber: 2.7g
Protein: 1.08g
Vitamin C: 10.4mg

A cup of raw fennel slices contains just 27 calories, with nearly three grams of fiber, which is essential for digestive health. It packs nearly 12% of the daily goal for immune-supporting vitamin C. Fennel also contains potassium, manganese, calcium, iron, and B vitamins.[19]

Risks of Fennel

Like all foods, you should enjoy fennel in moderation. Too much fennel may expose you to estragole, a carcinogen found in fennel, and may promote the growth of cancer cells.[20]

Children may be particularly vulnerable to the effects of estragole. Research from 2014 found that children have a margin of exposure when drinking one to three cups of fennel tea a day which calls for priority for risk management. The margin of exposure is a measurement of safety concerns within the food.[20]

Moreover, some herbs (including fennel) may cause nipple discharge.[21] Fennel can also interact with certain medications, such as Tamoxifen, which is a treatment for breast cancer.[22]

Additionally, fennel can negatively affect pregnant people and developing fetuses. For example, in one study published in 2015, researchers found

that regular use of fennel during pregnancy was associated with a lower gestational age.[23]

People with seizure disorders should avoid fennel essential oil since it can induce seizures in some people.[24]

You should check with a healthcare provider before using fennel as an oil or supplement, especially if you have any underlying conditions.

Tips for Consuming Fennel

Fennel has a licorice-like aroma, but the fresh bulb is light, bright, and mild. The taste is slightly sweet with a hint of perfumy flavor, but it's delicate and not overpowering.

When shopping for fresh fennel, look for a small- to medium-sized heavy, intact white bulb that's unbruised, with bright green firm stalks and feathery leaves. Fennel seeds have a stronger anise flavor that's warm and sweet. This is why they're typically used as a seasoning, rather than eaten like sunflower or pumpkin seeds.

You can eat fennel raw or cooked. Consider preparing it in one of the following ways:

- Shave or thinly slice the bulb and add the shavings to salads along with sliced apples.
- Marinate in a lemony extra virgin olive oil (EVOO) vinaigrette.
- Sauté it in EVOO on the stovetop.
- Oven roast in EVOO that's been seasoned with sea salt and black pepper.

Most recipes call for the bulb, but the delicate green tops are also edible. You can mince and use them as a garnish for everything from mashed cauliflower to roasted spaghetti squash and lentil soup.

Look for fennel seeds in the spice aisle. Add them to hearty dishes, like lentil bolognese, potato or white bean soup, or homemade bread.

Is fennel good for you? Health benefits, nutrition, and more

Fennel is a vegetable with a licorice-like flavor. It contains potassium, magnesium, and other nutrients with an antioxidant effect. Benefits of fennel may include supporting digestion and preventing skin damage.

Foeniculum vulgare, or fennel, has a pale bulb and long green stalks. It can grow almost anywhere. All parts of the fennel plant, including the bulb, stalk, leaves, and seeds, are edible.

In this article, we detail the health benefits and nutritional content of fennel.

Benefits

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Fennel is low in calories but rich in nutrients linked to many health benefits.

The main fennel bulb is a plant-based source

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of potassium, sodium, phosphorus, and calcium. It is also high in essential fatty acids and magnesium.

People can also use fennel seeds, leaves, and flowers in different ways.

Research shows

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that fennel seeds may have antioxidant, anti-inflammatory, anti-fungal, and antiviral effects. A 2020 systematic review found that digesting these seeds may also stimulate prolactin to help mothers naturally produce breast milk. A person can ingest fennel seeds in dishes or as an extract.

People can also steep fennel seeds, leaves, and flowers to make tea. Fennel tea may aid digestion and other gastrointestinal issues such as heartburn, bloating, loss of appetite, and colic in infants.

Bone health

The vitamin and mineral content in fennel contributes to building and maintaining bone structure and strength in the following ways:

- Phosphate and calcium: Both of these compounds are important in developing and maintaining strong bones.
- Iron and zinc: These are crucial for the production and maturation of collagen.
- Manganese: This mineral is necessary for bone matrix formation.
- Vitamin K: Studies associate low intakes of vitamin K with a higher risk of bone fracture.

Blood pressure

Insufficient potassium intake can increase

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a person's risk of developing high blood pressure.

In addition, there is evidence that potassium, calcium, and magnesium decrease blood pressure naturally. All of these are present in fennel.

Dietary nitrates in fennel and other foods have vasodilatory and vasoprotective properties. Because of this, they can help lower blood pressure and protect the heart. A 2018 study found that blood pressure levels were lower after taking nitrate supplements.

Heart health

Fennel contains significant amounts of fiber. Fiber decreases

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the risk of heart disease as it helps reduce both the total serum cholesterol and low-density lipoprotein (LDL) cholesterol in the blood.

Learn more about cholesterol here.

Vitamin B-6 and folate prevent the build-up of a compound called homocysteine by converting it into a different compound, methionine. When excessive amounts of homocysteine build up, it can damage blood vessels

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and lead to heart problems.

Cancer

Selenium is a mineral found in fennel absent in many other fruits and vegetables. It contributes to liver enzyme function and helps detoxify some cancer-causing compounds in the body.

Selenium can also prevent inflammation

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and decrease tumor growth rates.

Fiber intake from fruits and vegetables like fennel is associated with a lower risk

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of colorectal cancer.

Vitamin C, vitamin A, and beta-carotene are potent antioxidants that can help protect cells against damage from free radicals.

Immunity

The selenium found in fennel appears to stimulate the production of killer T-cells and modulates the immune system in other ways. Studies have shown dietary intake of selenium can improve immune response, especially to viral agents.

Metabolism

Fennel is a source of vitamin B-6, which plays a vital role in energy metabolism by breaking down carbohydrates and proteins into glucose and amino acids. The body can easily use these smaller compounds for energy.

Digestion and regularity

The fiber content in fennel helps to prevent constipation and promotes regularity for a healthy digestive tract.

Weight management and satiety

Dietary fiber is an important factor in weight management and works as a “bulking agent” in the digestive system.

These compounds increase satiety and reduce appetite, making an individual feel fuller for longer and lowering overall calorie intake.

A 2015 study

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found that females who drank fennel tea before a meal reported feeling fuller than females who had received a placebo, further suggesting that fennel may help suppress appetite.

Increasing iron absorption

Iron deficiency is one of the most common nutrient deficiencies globally and is the leading cause of anemia.

Pairing high-vitamin-C foods, such as fennel, with iron-rich foods can improve the ability of the body to absorb iron.

Estrogen

Estrogen occurs naturally in fennel. It plays a central role in regulating the female reproductive cycle, and it can also determine fertility.

A study on mice found that estrogen plays an important role in controlling factors that contribute to body weight, such as appetite, body fat distribution, and energy expenditure.

Changes in a person's estrogen levels can lead to weight changes.

Postmenstrual syndrome

A 2020 study found that consumption of fennel seed powder reduced menopausal symptoms in postmenopausal women over 8 weeks

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Skin

Raw fennel is an excellent source of vitamin C. Vitamin C is essential

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to collagen synthesis, the skin’s support system. It works as an antioxidant to help prevent damage caused by the sun, pollution, and smoke.

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Original Article

Effect of Fennel on the Health Status of Menopausal Women: A Systematic and Meta-analysis

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Objectives: The aim of the present study is the systematic and critical investigation of the effectiveness of fennel on the climacteric symptoms among menopausal females.
Methods: A search of the trials studying the effect of fennel on menopausal females was conducted in 2017 using the MEDLINE and Scopus databases and the Cochrane Library with the following keywords: fennel, *Foeniculum vulgare*, and menopause.
Results: Fennel combined with officinalis is more effective in the attenuating of sleep disorders compared to Citalopram. The comparison of these two groups regarding the mean bone mineral density and bone mineral content (P = 0.14, P = 0.504); the total hip femoral (P = 0.42, P = 0.66); the trochanter (P = 0.075, P = 0.07); the intertrochanter (P = 0.84, P = 0.93); and the femoral neck (P = 0.43, P = 0.64) did not show any significant statistical differences; however, a statistically significant difference regarding the vasomotor symptoms (P < 0.01) was found. The other significant differences are related to the values of the total cholesterol (P = 0.103); low-density lipoprotein cholesterol, or LDL-C (P = 0.104); high-density lipoprotein cholesterol, or HDL-C (P = 0.266); triglyceride (P = 0.679); body weight (P = 0.212); body mass index (P = 0.041); waist and hip circumferences (P = 0.365); and fat distribution (P = 0.337) between the two groups. The standardized mean difference (SMD) values of sexual activity (SMD = 0.638; P < 0.001), and maturation value (SMD = 0.601; P = 0.003) are highly significant among the fennel-treated women compared with the placebo group.
Conclusions: According to the findings of the present study, fennel is important in the relieving of vasomotor symptoms, vaginal itching, dryness, dyspareunia, sexual function, sexual satisfaction, and sleep distribution. **(J Menopausal Med 2018;24:67-74)**

Key Words: Foeniculum · Health status · Menopause · Meta-analysis

Introduction

The menopause as a natural biological phenomenon experienced by all women[1~3] refers to the permanent cessation of the menstrual cycle as a result of ovarian dysfunction.[4] The menopause is characterized by estrogen deficiency that is associated with the vaginal atrophy, bone loss, mood variations and hot flashes.[5]

One of the major causes of mortality and morbidity in elderly women is osteoporosis that imposes huge financial burden on the society.[6,7] Among which, there are several complications following the use of chemical medications in treating the osteoporosis; for example, raloxifene that is associated with some adverse effects of vein thrombose and

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pulmonary embolism.[8] Reportedly, the menopause females frequently suffer from the psychological symptoms such as anxiety and depression[9]; in this regard, benzodiazepines and antidepressants have a wild therapeutic application for the mood variations among menopausal women, resulting in complications like sleepiness and dependence as well as anticholinergic and cardiotoxic effects.[9] The hormone therapy has shown to protect the bone mass and to improve vasomotor symptoms and vaginal dryness. The hormone replacement therapy lost its therapeutic value due to unexpected side effects reported by the Women's Health Initiative, such as increased risk of cardiovascular and breast cancer and venous thrombosis.[10,11]

Following the mentioned healthcare concerns, the use of phytoestrogens has attracted further attentions in treating the menopause-related disorders, including fennel (*Foeniculum vulgare*). It has been extensively employed by Iranian traditional medicine in the management of carminative, diuretic, tonic,[12] nausea, flatulence, colic, spleen and gall bladder digestive complaints,[13~15] depression and anxiety, vaginal atrophy, bone density, fat distribution, osteoporosis, sexual function, lipid profiles, quality of life (QOL) and sexual satisfaction. This medicinal plant contains phenolic compounds, flavonoids (flavonoid glycosides and flavonoid aglycons), phenolic acids, hydroxycinnamic acids, coumarins and tannins.[15] To the best of our knowledge, this is the first systematic review investigating the fennel effects on the menopause symptoms.

Materials and Methods

The trials studying the effect of fennel on the menopause were searched on databases of MEDLINE, Scopus, Google Scholar, and Cochrane Library (Cochrane Central Register of Controlled Trials) using the keywords of (fennel and *Foeniculum vulgare*) and menopause in any language in 2017. The respective publications were identified by manual manner among the references of studies.

1. Inclusion criteria

The study inclusion criteria were randomized controlled trials (RCTs), postmenopausal women and assessment of the fennel effects on at least one menopausal symptom.

2. Data extraction

Two separate assessors extracted the data, including sample size, type of intervention and control, duration of treatment, dose and outcomes. Consensus-based discussion eliminated any disagreement (Table 1).

3. Assessment of publication bias

Publication bias was measured using Cochrane Collaboration's 'Risk of bias' tool (Table 2).

4. Statistical analysis

The main effect size was considered to be the standardized main difference (SMD). Pooling studies were performed using a random statistical model. Cochrane Q test ($P < 0.05$) and I^2 index were calculated to obtain the heterogeneity. The analyses were statistically carried out using a Comprehensive meta-analysis version 2 (Biostat, Englewood, NJ, USA).

Results

Process of studies selections was display in Fig. 1. In total, 10 studies (five duplicate publications) were included to systematic review. Some studies were reported as qualitative and some other studies that had sufficient information included in meta-analysis.

1. The fennel combined with officinalis (Melissa) effect on sleep disorder

Only one study by Shirazi et al.[16] assessed the effectiveness of fennel combined with officinalis (Melissa) in treatment of sleep disorder. Sixty menopausal women with sleep disturbances were randomized into one of three groups (Melissa, citalopram, and placebo) for a 2 months follow-up period. Melissa group received 300 mg of fennel combined with 300 mg of officinalis daily (once a day). Citalopram group received 20 mg of citalopram and then the dose increased to 30 mg after one week. The patients were asked to complete Pittsburgh Sleep Quality Index (PSQI) Questionnaire before and again after treatment. PSQI had seven components: subjective sleep quality, sleep latency, sleep

Table 1. Characteristics of 10 studies (5 duplication publications) included in our systematic review

References	Length of study (weeks)	Measurement outcome	Drop out (%)	Type of treatment/Control group	No. of subjects (active/placebo)
Ghazanfarpour et al.[3]	12	Anxiety, depression	18.2%	30% capsules filled with 100 mg fennel, three times a day/Placebo	25/24
Shirazi et al.[16]	8	Sleep disorder	0.0%	300 mg of fennel combined with 300 mg of officinalis daily/Placebo	30/30
Yaralizadeh et al.[18]* Najar et al.[19]*	12	Vaginal atrophy, sexual satisfaction	0.0%	Fennel 5% vaginal cream/Placebo	30/30
Ghazanfarpour et al.[17]	12	Vaginal atrophy	13.0%	30% capsules filled with 100 mg fennel, three times a day/Placebo	25/27
Kian et al.[20]	8	Score of sexual and vasomotor of MENQOL	11.0%	30% capsules filled with 100 mg fennel	45/45
Saghafi et al.[23]* Afiat et al.[24]* Ghazanfarpour et al.[22]*	12	Body composition, lipid profile, BMD, and BMC of the spine, femoral neck, intertrochanteric, and trochanter	15.0%	30% capsules filled with 100 mg of fennel, three times a day/Placebo	30/30
Abdali et al.[21]	8	FSFI	0.0%	Hypericum perforatum (total dose 160 mg of hypiran), fennel tables per day (total dose 90 mg)/Placebo	Hypericum perforatum (n = 33), fennel (n = 33), hypiran, placebo (n = 32)

*Duplicate publications
MENQOL: menopause-specific quality of life questionnaire, BMD: bone mineral density, BMC: bone mineral content, FSFI: female sexual function index

Table 2. Assessment of risk of bias using Cochrane Collaboration's 'risk of bias' tool of 10 randomized placebo-controlled trials included in our systematic review

References	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition)	Selective reporting	Other biases
Ghazanfarpour et al.[3]	(+)*	(+)	(+)	(+)	(-)	(+)	(+)
Shirazi et al.[16]	(?)‡	(-)†	(+)	(+)	(+)	(+)	(+)
Yaralizadeh et al.[18] Najar et al.[19]	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Ghazanfarpour et al.[17]	(+)	(+)	(+)	(+)	(-)	(+)	(+)
Kian et al.[20]	(+)	(?)	(?)	(?)	(+)	(+)	(+)
Saghafi et al.[23] Afiat et al.[24] Ghazanfarpour et al.[22]	(+)	(+)	(+)	(+)	(-)	(+)	(+)
Abdali et al.[21]	(?)	(?)	(?)	(?)	(+)	(+)	(+)

*(+): low risk of bias
†(-): high risk of bias
‡(?): unclear risk of bias

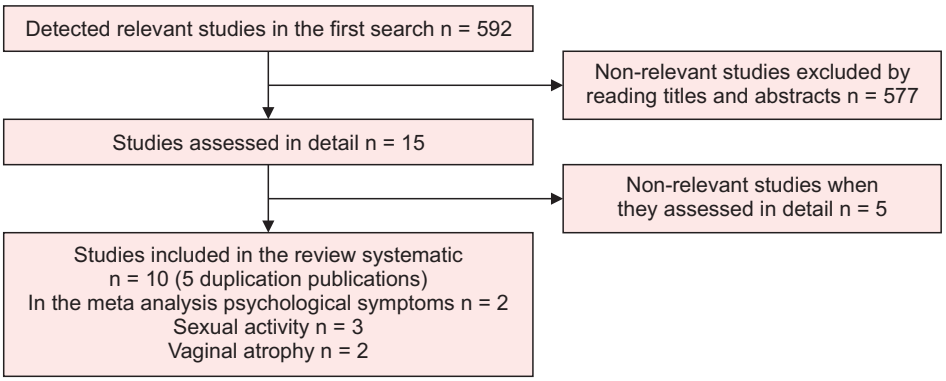

Fig. 1. Study search strategy.

duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication and daytime dysfunction. Compared to baseline, all seven component of PSQI showed a statistical significant improvement in all of three groups. There was a statistical significant difference between Melissa group compared with both Citalopram and placebo.[16]

2. Oral and topical fennel effect atrophy vaginal and sexual function

Two studies investigated fennel effect on atrophy vaginal.[17,18] One study evaluated oral fennel effect on atrophy vaginal. Sixty menopausal women divided into fennel (n = 30) and vaginal placebo group (n = 30). No significant differences were observed in fennel group in respected to Vaginal Maturation Index ($P = 0.64$), the percentages of the parabasal ($P = 0.191$), intermediate ($P = 0.219$) and superficial ($P = 0.82$). However, paired t-test for comparison between before and after showed a significant increase in intermediate and superficial cells and a decrease in the parabasl cells.[17]

Yaralizadeh et al.[18] compared the effect of 5% fennel vaginal cream (n = 30) with vaginal cream (n = 30) on vaginal atrophy. A significant increase in the superficial cells ($P < 0.001$) and significant decline in parabasal ($P < 0.001$) and intermediate ($P < 0.001$) was observed in fennel group compared to placebo. Also more improvement was seen in the vaginal cream fennel group compared to the placebo group regarding symptoms itching ($P = 0.017$), dryness ($P < 0.001$), pallor ($P < 0.001$) and dyspareunia ($P < 0.001$) except for burning ($P = 0.14$). Combining the finding of these two studies through random effect model reveal that pooled SMD of maturation value 0.601 ($P = 0.003$) was significant (95% confidence interval [CI], −0.205 to 0.998) and any heterogeneity ($I^2 = 66.74$, $P = 0.083$) was not observed between two studies (Fig. 2).

3. Fennel effect on sexual function and sexual satisfaction

Three studies investigated the effect of fennel on sexual function and sexual satisfaction. Najar et al.,[19] in duplicate study, performed the first study. They assessed the fennel effect on sexual satisfaction. Treatment with fennel improved significantly sexual satisfaction compared to control group. Also patients in fennel group reported lower dyspareunia score than those in control group.

Seconded trial conducted by Kian et al..[20] They assessed the effect of fennel on score sexual of menopause-specific QOL (MENQOL), 90 patients randomized into fennel (n = 45) and placebo (n = 45) group. In both group fennel (24%) and placebo group (13%), mean score of sexual domain decreased significantly. The result of covariance analysis indicated a significant difference between two group ($P = 0.013$).[20]

The third trial by Abdali et al.[21] compared three arms: fennel, Hypericum perforatum and placebo. They conducted a blind placebo-controlled clinical trial on 120 menopausal women. Patients were randomized into one of three groups. The 33 patients received three tablets Hypericum perforutum (total dose 160 mg of hypiran), 33 patients received three fennel tables per day (total dose 90 mg) and the last 32 patients received three tablet placebo per day. Sexual function was measured using the female sexual function index. Inter-group comparison showed a significant difference in Hypericum perforutum ($P < 0.001$), fennel ($P < 0.001$) and placebo ($P < 0.001$) across three-time interval (baseline, 4

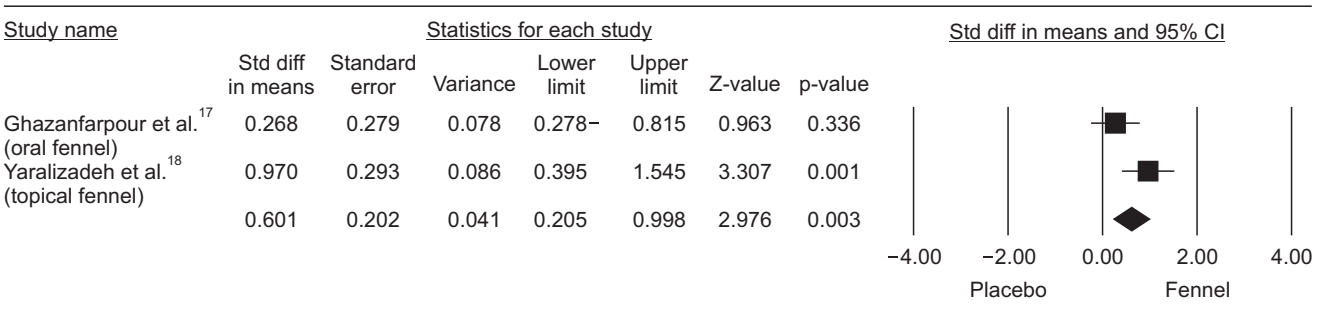

Fig. 2. Effects of fennel on vaginal atrophy. ■: point estimate, ♦: combined overall effect of the intervention. CI: confidence interval.

and 8 weeks). Comparison among groups showed a significant difference at 8 weeks (P = 0.007) but these difference was not significant at baseline (P = 0.172) and week 4 (P = 0.477). Both fennel (P = 0.012) and Hypericum perforutum (P = 0.029) were difference from placebo at week 8.[21] Combining the finding of these three studies through random effect model reveal that pooled SMD of sexual activity was highly significant than in women treated with fennel compared to placebo (SMD = 0.611; $P < 0.001$; 95% CI, 0.330–0.839; heterogeneity; I^2 = 57.58, P = 0.095) (Fig. 3).

4. The effect of fennel on vasomotor symptom

Only one trial by Kian et al.[20] assessed the effect of fennel on vasomotor domain of the MENQOL questionnaire. Vasomotor include three symptoms: hot flash, night sweet and sweeting. Vasomotor domain decreased significantly from 15.17 to 8 in fennel group ($P < 0.001$) and from 13.22 to 15 (P = 0.02) in placebo group. Inter group comparison between two group was significant ($P < 0.01$).

5. The effect of fennel on bone density postmenopausal women

Only one trial evaluated the short-term effectiveness of treatment with fennel on bone density in postmenopausal women. Women randomized into two groups fennel (n = 30) and placebo (n = 30). Subjects took three capsules daily for 12 weeks. Each fennel soft capsule contained 30% fennel oil. Bone mineral density (BMD) and bone mineral content (BMC) of the spine, femoral neck, intertrochanteric, and trochanter were measured at baseline and after 12 weeks. Inter comparison of two groups regarding mean BMD and BMC at lumbar spine (P = 0.14, P = 0.504), total hip femoral (P = 0.42, P = 0.66), trochanter (P = 0.075, P = 0.07), intertrochanter (P = 0.84, P = 0.93) and femoral neck (P = 0.43, P = 0.64) was not statistically significant.[22]

6. The effect of fennel on depression in postmenopausal women

Two studies investigated fennel effect on psychological symptoms.[3,20] Ghazanfarpour et al.[17] conducted a randomized clinical trials on forty nine Iranian postmenopausal women who randomized to fennel (n = 25) and placebo (n = 24). Fennel group received capsule containing fennel and placebo group received placebo capsule. Zung's Self-Rating Depression Scale (SDS) and Hospital Anxiety and Depression Scale (HADS) were measured baseline and again after 12 weeks. Inter group comparison (fennel and placebo) did using t-test showed no significant difference regarding HADS subscale depression (P = 0.83) and anxiety (P = 0.83) and SDS (P = 0.91). In 44% patient in fennel group and 37.5% in placebo group were depression. After administration of fennel, depression level decreased borderline significant (P = 0.058). In 40% patient in fennel group and 45.8 patients in placebo group, the diagnosis of anxiety were confirmed. A significant improvement ($P < 0.01$) was seen after treatment with fennel.[3]

Only one trial by Kian et al.[20] assessed fennel effect on psychological domain of the MENQOL questionnaire. Score of socio-psychological of MENQOL decreased significantly from 30.77 ± 11.40 to 19.48 ± 7.68 in fennel group ($P <$ 0.001) and decreased significantly from 28.12 ± 10.18 to 25.20 ± 8.58 ($P < 0.001$) in placebo group. Inter group

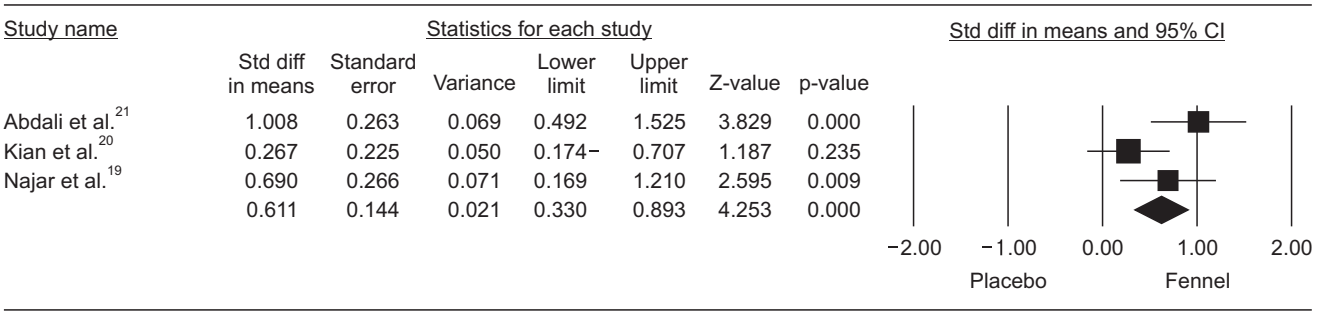

Fig. 3. Effects of fennel on sexual activity. ■: point estimate, ♦: combined overall effect of the intervention. CI: confidence interval.

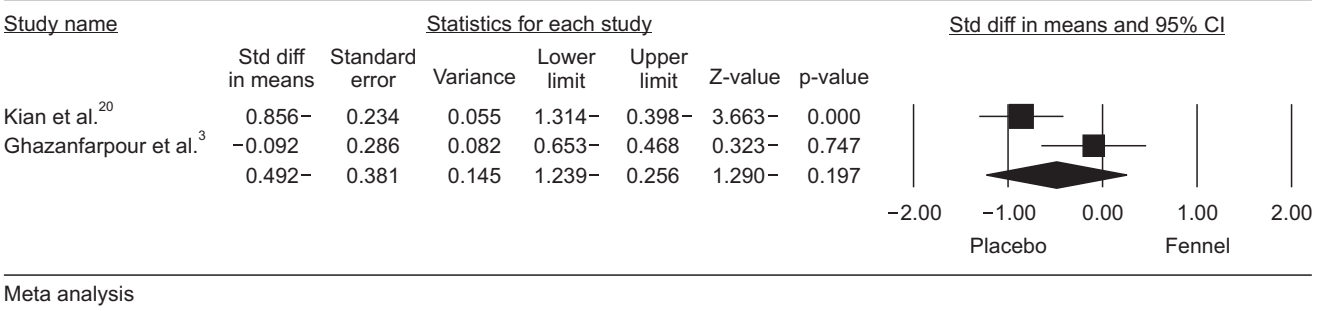

Fig. 4. Effects of fennel on psychological symptoms. ■: point estimate, ♦: combined overall effect of the intervention. CI: confidence interval.

comparison between two group was significant ($P < 0.01$).[20] Combining the finding of two studies through random effect model reveal that pooled SMD of psychological symptoms was not significant (pooled SMD = −0.492, $P = 0.197$, 95% CI, −1.23 to 0.256). However heterogeneity was significant ($I^2 = 76$, $P = 0.03$) between two studies (Fig. 4).

7. The effect of fennel on composition in postmenopausal women

Only one study by Saghafi et al.[23] investigated the effect of fennel on body composition in overweight and obese postmenopausal women for 3 month. Twenty-two in the fennel group and 25 in placebo group completed the trial. Measure outcomes were body weight, body mass index (BMI) and fat distribution. Comparison of two groups (fennel and placebo) did not show any significant difference regarding body weight, BMI, waist and hip circumferences and fat distribution. Also, difference before and after treatment was not significant treatment regarding these parameters in both groups.[23]

8. The effect of fennel on lipid profiles postmenopausal women

One study assessed the effect of fennel on lipid profiles. Sixty postmenopausal women were randomized into fennel group and placebo groups. Measure outcomes were low-density lipoprotein cholesterol (LDL-C), plasma total cholesterol, high-density lipoprotein cholesterol (HDL-C) and triglycerides. Comparison of two groups did not show any significant difference in total cholesterol ($P = 0.103$), LDL-C ($P = 0.104$) and HDL-C levels ($P = 0.266$), triglyceride ($P = 0.679$) between the two groups.[24]

Discussion

As far as know, this is the first study to assess the fennel effect on the menopausal women's health. According to two trials, both routes (oral and topical) had positive effect on vaginal epithelium. However, the fennel had more effect when it applied topically. Based on the two trials,[3,20] the

fennel had beneficial effects on some psychological disorders such as anxiety and depression. The fennel seems to have more effect in the patients with depression or anxiety disorders. The women treated with the fennel showed reportedly higher sexual function and sexual satisfaction in compared to the placebo group. The menopausal women in the fennel group experienced a slight increase in body weight and fat distribution. The fennel combined with the officinalis was more effective in attenuating the sleep disorders compared with Citalopram. There were not any significant differences in term of total cholesterol, LDL-C, HDL-C levels and triglyceride levels between the studied groups.

A trial assessing the effect of the fennel on the bone density found no proactive effect on the bone loss, inconsistent with other in vitro and animal studies. An in vitro study reported the protective effect of the fennel on the bone loss.[25] Both low and high doses of the fennel significantly improved the mean BMD and BMC at lumbar spine.[26] A possible explanation for this difference might be attributed to only 12-week follow up in current study. It should be noted that the potential beneficial effects of this herb could be proved through further studies with prolonged follow up and larger sample sizes.

Several issues make it difficult to express the beneficial effects of the fennel on the sleep disorders, including high placebo effect, limited studies, and small sample size. The fennel may have indirect effect in treatment sleep disorder through improving depression and anxiety. Accordingly, the direct and indirect effects of fennel on depression and anxiety should be investigated excessively through path analyses.

The conclusions of this review might not be globally generalized because all most of studies performed in Iran. Also, out of 45 studies in systematic review, three studies were published in duplicate sample. High placebo response was found among the studies that met our inclusion criteria. It is recommended that the researches should enter placebo run in phase and then exclude the patients with high placebo effect. Physical activity and nutritional status of the subjects have not been measured during treatments in some studies.

Conclusion

According to the findings, the fennel had been reported important in relieving the vasomotor symptom, vaginal itching and dryness, dyspareunia, sexual function, sexual satisfaction and sleep distribution. Fennel may have the limited positive effect in patients with depression or anxiety disorder but not healthy women. There were no effect on body weight and fat distribution, bone density and lipid profiles. However, these conclusions should be claimed cautiously because of small sample size, limited studies, high placebo effect and lack of physical and nutritional assessments duration treatment.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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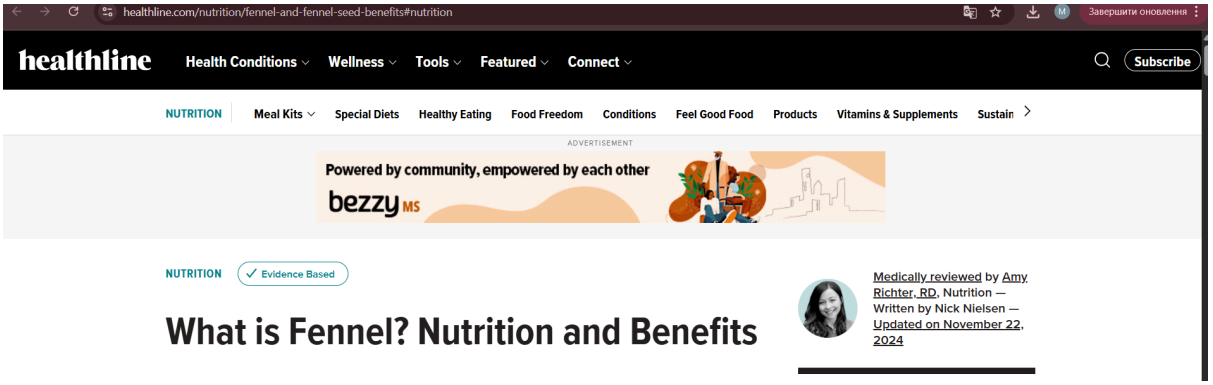

What is Fennel? Nutrition and Benefits

Fennel is a vegetable native to the Mediterranean with alicorice-like flavor. Its edible bulbs, leaves, and seeds are used in various cuisines worldwide.

Although fennel is native to the Mediterranean, it now grows in many parts of the world. The bulb is often cooked, but can also be eaten raw in foods like salads or pastas. Fennel seeds are used as a spice in baked goods, meats, and beverages.

Fennel nutrition

One raw fennel bulb contains:

- Calories: 72.8
- Carbohydrates: 17.2 grams (g)
- Protein: 2.91 g
- Fat: 0.47 g
- Fiber: 7.28 g

The main parts of the fennel plant are a good source of potassium, sodium, phosphorus, and calcium.

Potential benefits of fennel

Fennel is a good source of carbohydrates and dietary fiber. It also provides important vitamins and minerals and may help support a heart-healthy diet.

Heart health

Fennel is high in dietary fiber, which may help protect your heart.

manage your cholesterol and blood sugar, reducing your risk of cardiovascular disease.

The fennel plant and seeds also have antioxidant and anti-inflammatory properties. Chronic inflammation increases your risk

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of cardiovascular conditions like heart attack and stroke.

Anxiety

Fennel has been used traditionally to treat anxiety. According to a 2022 review, extracts from fennel may improve anxiety symptoms.

However, most of these studies were done with animals or had small sample sizes. Because of this, more research may be needed.

Digestion

The anti-inflammatory properties of fennel may help reduce symptoms of inflammatory bowel disease (IBD).

Fennel seeds are traditionally used as a digestive aid in various cultures. A 2022 study found that fennel seed extract protected against gastrointestinal inflammation in mice.

While the protective effects of fennel might be useful for treating IBD symptoms, more studies are needed in humans.

How to prepare fennel

Fennel has a mild flavor that resembles licorice or anise and has a texture similar to celery. You can eat almost every part of the fennel plant, including the bulb, leaves, and seeds.

The bulb is the round part of the fennel plant at the base of the stalks. You can prepare fennel bulbs like a root vegetable by roasting, braising, or boiling. You can also eat sliced fennel bulbs raw as an ingredient in salad or coleslaw.

The leaves of the fennel plant are commonly used as garnish, but they can also be eaten as a vegetable, cooked or raw.

Fennel seeds are mainly used as a spice to add an anise-like flavor to baked goods, meats, or drinks. You can also try chewing fennel seeds as a natural breath freshener.

Fennel safety concerns

Fennel contains a compound called estragole, which is found in essential oils.

Essential oils containing estragole may be carcinogenic and are linked to developmental issues during pregnancy in animal studies.

However, the amount of naturally occuring estragole in fennel is low. Still, more research in humans is needed to understand its effects.

The bottom line

Both the flavorful, crunchy bulb and aromatic seeds of the fennel plant are nutritious and may offer some health benefits.

To reap the benefits of fennel and its seeds, try incorporating raw fennel bulb into your salads or using the seeds to flavor soups, broths, baked goods, and fish dishes.