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## Effect of fennel (*Foeniculum vulgare* Mill) seed supplementation on pain intensity among women experiencing primary dysmenorrhoea

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Primary Dysmenorrhea is by far the most prevalent menstruation problem, and women of all ages routinely self-treat it. Teenagers are more likely than adults to have dysmenorrhea symptoms and choose OTC treatments without adult supervision. For dysmenorrhea discomfort, nonsteroidal anti-inflammatory medications and combination oral contraceptives are the first-line treatments, but numerous nutritional and herbal remedies have also shown potential like fennel seeds, cinnamon and ginger. They have shown promising effects in reducing pain among women experiencing primary dysmenorrhea.

**Keywords:** Dysmenorrhea, Fennel Seeds, Menstrual Cycle

### INTRODUCTION

Dysmenorrhea is a Greek word that means "difficult monthly cycle stream" or "excruciating feminine disorders of uterine origin." (French, 2019). For all women, menstruation is a normal and expected physiological interaction (Dyawapur, 2018). Dysmenorrhea is a common gynecological problem that affects at least half of all women during their reproductive cycle, regardless of gender. Despite the fact that dysmenorrhea does not take lives, it has an effect on the behavior of women's lives, causing women to miss work or education, which has a significant negative impact on the local economy. Dysmenorrhea is divided into essential and auxiliary types based on the physical and obsessive symptoms. Essential dysmenorrhea is defined as feminine pain without ovarian pathology and is most commonly observed in youngsters, whereas optional dysmenorrhea is defined as a painful monthly cycle accompanied by pathology (Moslemi, 2019).

#### Primary Dysmenorrhea

Endometrial slash causes primary dysmenorrhea, a severe uterine constriction. Primary dysmenorrhea usually occurs either before or after the start of the female stream, and the pain lasts for 48 to 72 hours. With essential dysmenorrhea, general side effects such as nausea and heaving (89 percent), disquietude, shortcoming (85 percent), lower spine pain (60 percent), loose stools (60 percent), and migraine (45 percent) may be present (Durain, 2016). Dysmenorrhoea affects 60 percent to 96 percent of young women and men. It only occurs during

ovulatory cycles and in women who have high amounts of or increased sensitivity to prostaglandins. Prostaglandins cause myometrial constriction, ischemia, and the refining of anguish filaments, all of which contribute to pelvic pain (Nazari, 2020). Dysmenorrhoea has been proven in studies to be one of the most troublesome factors impacting young women's life quality and social behavior, it renders them helpless and torpid, especially if symptoms such as migraines, shortness, vomiting, and spasm are present (Hailemeskel, 2016).

The most well-known pharmacologic medications for dysmenorrhea are nonsteroidal anti-inflammatory drugs (NSAIDs) and oral preventative pills, both of which function by reducing uterine compressions (Hubacher, 2015). NSAIDs work by preventing the production of prostaglandins. Traditional therapy, such as non-steroidals, have a high success rate; however, the disappointment rate is still around 20 percent to 25 percent.

The majority of women do not seek medical therapy because they understand that it will not help them manage their dysmenorrhea (Oladosu, 2018). Likewise, some women with primary dysmenorrhea may not be able to tolerate the side effects. Currently, a large number of clients are looking for alternatives to traditional medicine (Kim, 2017).

In recent years, there has been a surge in the use of homegrown pharmaceuticals in a variety of infectious problems, owing to a variety of factors, one of which is the

possibility of establishing unfriendly medication reactions to synthetic medications. Fennel is one of the natural remedies that has been proposed (Yarnell, 2015). Fennel is grown in many parts of Europe and Asia, with much of it coming from India, China, and Egypt. For years, the pith of a verdant, aromatic plant known as *Foeniculum vulgare* has been used in the Mediterranean region to relieve the agony of the monthly cycle (Yarnell and Bahmani, 2016). Many studies have shown the effectiveness of homegrown therapies for essential dysmenorrhea, such as cinnamon tea, lavender, fenugreek, and fennel, among others (Díaz-Maroto, 2017). It's an Iranian herbal remedy that's been used to relieve period pain for quite some time (Abramson, 2007).

Fennel (*Foeniculum vulgare*)

Fennel (*Foeniculum vulgare*) is a yellow-flowering spice. *Foeniculum vulgare* is a sweet-smelling, biennial restorative plant that belongs to the Apiaceae family (Umbelliferae). With golden blooms and cushioned leaves, it is a powerful, perennial umbelliferous spice. With empty stems, it grows to a height of up to 2.5 meters. The surrenders grow to be 40 cm long and are carefully dismantled into filiform (string-like) parts roughly 0.5 mm diameter. Terminal compound umbels produce the blooms. The natural substance is a 4–10 mm long dry seed. It is often regarded to be native to the Mediterranean Sea's beaches, although it has grown widely naturalized in many parts of the world, particularly on soil surface at the ocean's edge and along stream banks. Fennel has two sub-types, *piperitum* and *vulgare*, according to some creators: Because of their signature anise flavor, sub-species *piperitum* contains disagreeable seeds, whereas sub-species *vulgare* has sweet seeds that are used as enhancing specialists in prepared goods, meat and fish meals, frozen smoothies, cocktails, and so on (Nazari, 2020). Fennel seeds, both fresh and dried, are used in cooking. The dried seeds and oil are also used to treat various ailments. Using fennel oil or seeds via mouth seems to aggravate anguish in people who have female problems. It may have an analgesic effect similar to ibuprofen or mefenamic acid (Kooti, 2015). Fennel is an estrogenic and mitigating substance.

It has been shown to be effective for the treatment of essential dysmenorrhea (Ghods et al., 2018). It is regarded as one of the world's most important therapeutic plants due to the financial relevance and essential drug company applications (Nazarpour, 2018). Fennel seeds, *Foeniculum vulgare*, have been demonstrated in studies to reduce female discomfort by lowering the level of prostaglandins in blood circulation (Nazarpour and Barros, 2018).

### Nutritional Composition of Fennel

Phosphorus, zinc, copper, manganese, selenium, niacin, pantothenic acid, folate, choline, beta-carotene, lutein, zeaxanthin, vitamin E, and vitamin K are also found in fennel. Fennel, like these, provides substantial levels of

dietary nitrates and is a wellspring of estrogen. Fennel naturally contains estrogen. It has a key role in regulating the female reproductive cycle, as well as alleviating cramps and determining fertility (Weissman, 2020).

### Prevalence of Dysmenorrhea

Dysmenorrhea affects 67-90 percent of females between the ages of 17 and 24 who are of reproductive years across the globe (Torkzahrani, 2019). In Pakistan, 70-93 percent of young females suffer from dysmenorrhea (Gulzar, 2015). The personal satisfaction of women as a result of dysmenorrhea, as well as the lack of a few working days over long periods of ripeness, is a potential issue for any general public's economy. Dysmenorrhea is a common problem among women, and the most common treatment is non-steroid anti-inflammatory medicines. Fennel separate is now indicated for pain reduction if dysmenorrhea occurs. It is difficult to find research on the effects of fennel seed powder supplementation on pain power in essential dysmenorrhea (Gulzar et al., 2015).

### Mechanism of Action of Fennel Seeds

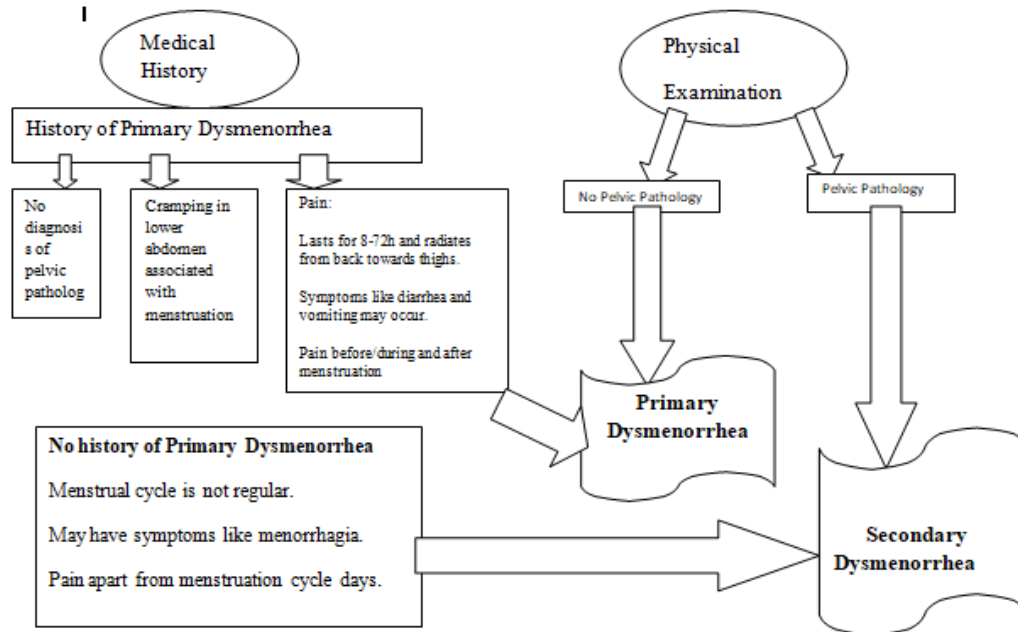
Fennel's potential influence could be linked to the plant's anti-convulsant properties. In terms of characteristics, anethole, the main fragrance in fennel seed, is equivalent. It possesses estrogenic effects as well. It reduces the production of prostaglandins, which are the source of pelvic pain (Nazari, 2020).

In 2018, Karimi et al. investigated the link between dysmenorrhea and overall health in university students. The findings of this study revealed that the average age of menarche for undergraduate students was 13.5 years, and that 82.8 percent of them suffer from dysmenorrhea, with 22.4 percent experiencing severe menstrual pain as evaluated by the Visual Analogue Scale. Moreover, it was more prevalent in understudies with a family history of dysmenorrhea. The results of the t-test revealed a strong link between true wellbeing and dysmenorrhea ( $P=0.036$ ). There were also significant results in terms of genuine adverse effects ( $P=0.026$ ), depression and overall health ( $P=0.001$ ), and feminine cycle irregularity ( $P=0.019$ ) (Karimi et al., 2020).

Lee et al. conducted research into the efficacy and safety of fennel seeds in the treatment of primary dysmenorrhea discomfort. Fennel seeds were found to be more effective than placebo in reducing pain in primary dysmenorrhea, and they can be utilized as a conventional pharmacological therapy for easing pain in dysmenorrhea, according to the findings of this study (Lee et al., 2020).

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**Figure 1: History and Examination of Dysmenorrhea.**

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The effectiveness of herbal medications (fennel, cinnamon, and ginger) in primary dysmenorrhea was investigated by Xu Y et al. As a result of the interventions, the severity of pain in the trial groups was considerably lower ( $P<0.001$ ) than in the control group. Cinnamon, fennel, and ginger proved to be useful in reducing the severity of dysmenorrhea pain (Xu et al., 2020).

The effects of fennel (*foeniculum vulgare*) on primary dysmenorrhea are investigated by Omidvar et al. The sixty females were separated into two groups, each with 30 girls. From the first day of their menstrual period, one group takes

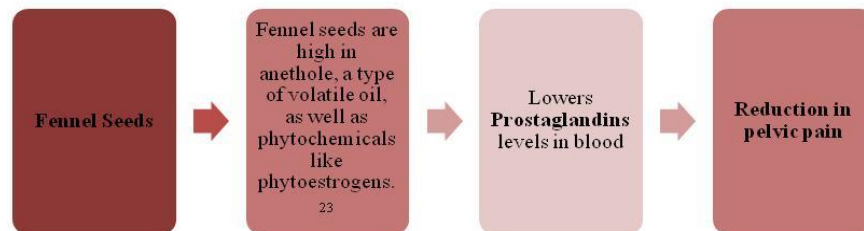
30 mg fennel capsules four times a day for three days. Another group is given a placebo pill with the same amount of wheat flour. In pain reduction, fennel was found to be more helpful than the placebo group ( $P<0.05$ ). Fennel was determined to be more beneficial as a herbal medication in the treatment of menstruation discomfort based on the findings (Omidvar et al., 2019).

Torkzahrani conducted a study in 2019 with the goal of determining the effectiveness of fennel on primary dysmenorrhea. There were 90 students in the study, and the case group received 5 capsules containing 46 mg of fennel extracts each day, whereas the control group received 5 placebo capsules. The reduction in pain intensity was measured using a verbal multidimensional scale. In the case group, there was a significant reduction in pain severity. Thus fennel is helpful in reducing pain ( $P<0.05$ ) (Torkzahrani et al., 2019).

Moslemi et al. conducted a study with 65 single woman students in 2019. 46mg fennel capsules and placebo capsules were given four times daily to the fennel and placebo groups, respectively, while 100 IU vitamin E capsules were given to the Vitamin E group. The pain intensity was measured using the Visual Analogue Scale. Significant reduction in the mean length of pain in the case group in the first and second months; substantial decrease in the total duration of pain in the 2nd month of vitamin E; and substantial decrease in the period of pain seen between three categories and decreased sedative use (Moslemi et al., 2019).

**Table: 1 Original Studies regarding Effect of Fennel Seeds on reducing pain in Primary dysmenorrhea**

Titles	Study Design	Subjects	Interventions	Duration	Results	References
Comparison of the effectiveness of combination of Fennel extract/vitamin E with ibuprofen on the pain intensity in students with primary dysmenorrhea	double-blinded quasi-experimental research method.	68 students (two groups of 34 students each)	fennel extract/ vitamin E ibuprofen	2 Months	fennel extract is effective on decreasing the intensity of pain of primary dysmenorrhea	Nasehi et al.,2017
The Effect of Fennel on Pain Quality, Symptoms, and Menstrual Duration in Primary Dysmenorrhea	Clinical trial study.	80 female Two groups of intervention (n = 40) and control (n = 40).	One soft capsule Fennel (30 mg) every 4 hours, 3 days before menstruation till the 5th day	3 months.	Fennel is effective to Relieve dysmenorrheal signs and menstrual Duration.	Ghodsi et al.,2018
Comparison of Effectiveness of Fennel versus Vitamin (E) on Primary Dysmenorrhea among Benha University Nursing Students	A quasi-experimental design was used. Setting	116 students divided into two equal groups	Fennel Vitamin E	3 months	students who received fennel seed's tea experienced less severe dysmenorrhea than students who received vitamin E	Mohamed et al.,2018
The effect of Fennel on the primary dysmenorrhea in students of Shahrekord University of Medical Sciences	Clinical Trial	60 girls	Fennel Wheat Flour	3 months	Fennel extract can reduce the primary dysmenorrhea	Delaram et al.,2018



**Figure 2: Mechanism of Action of fennel seeds in primary dysmenorrhea.**

In 2018, Asltoghiri M et al. undertook a study to see if fennel might help with primary dysmenorrhea problems and menorrhagia duration. It was part of a clinical investigation at Toyserkan's Islamic Azad University. It consisted of 80 female students who were split into two groups: intervention (n = 40) and control (n = 40). The intervention group received one soft capsule of Fennel (30 mg) every four hours starting three days before menstruation and continuing for three months. There was no medicine given to the control group. A visual analogue scale was used to

rate the degree of the pain in the samples. Visual analogue scale pain (VAS), McGill pain questionnaire, the spectrum of stress about dysmenorrheal (VASA), Stress scale, and Well-being scale are five typical surveys. It was determined that Fennel can be used to relieve dysmenorrheal symptoms and menstrual duration, given the safety of herbal remedies (Asltoghiri et al., 2018).

In 2017, Jahromi compared the effectiveness of *Foeniculum vulgare* variation sweet (Sweet Fennel) vs. mefenamic acid in the management of primary

dysmenorrhea. This study involved seventy women aged 15 to 24 years old from a nearby university and high school who complained of dysmenorrhea. Due to subsequent dysmenorrhea, ten cases were eliminated. On the basis of a verbal multidimensional grading system, the remaining 60 patients were categorized as mild, moderate, or severe. The study also excluded thirty participants with mild dysmenorrhea. Three cycles of testing were performed on each of the 30 instances of moderate to severe dysmenorrhea. The cases were treated with mefenamic acid (250 mg q6h orally) in the second cycle after receiving no medication in the first cycle (control cycle). In the third session, a 2 percent concentration of Fennel's fruit essence (25 drops q4h oral) was recommended at the start of the cycle. Using a self-scoring method, these cycles were analyzed with each day for effect, potency, timing of initiation of action, and problems associated for each treatment modality. Fennel essence was found to be an effective and safe herbal treatment for primary dysmenorrhea (Jahromi, 2017).

Sadeghian et al. published a study in 2017. This clinical experiment was conducted at Shahrekord University of Medical on sixty single students with mild - to - moderate dysmenorrhea. The pupils were split into two equal categories and given echinophora-platyloba extracts in one and fennel extracts in the other. The pain intensity scale was used to determine the degree of pain two cycles before and after the intervention. During the two phases before the intervention, there has been no substantial distinction severity of dysmenorrhea between both the two groups, but both medicines were able to lower the intensity of dysmenorrhea during the two cycles following the intervention. This reduction was lower in echinophora-platyloba extract users than in fennel extract recipients. It was determined that both Echinophora-platyloba and fennel extracts may reduce dysmenorrhea during the intervention, with fennel extract having stronger effects than echinophora-platyloba, hence fennel extract consumption is recommended for dysmenorrhoea (Sadeghian, 2017).

In the year 2020, Ghaffri et al. conducted research to see how Fennel seed powder affected estradiol levels, menstrual problems, and sexual attraction in post - menopausal women. The study involved 80 women between the ages of 45 and 60 who were sent to the Mofatteh Gynecologic Clinic in Yasuj, Iran. Participants were randomly assigned to one of two groups: intervention or control (control). Over the course of eight weeks, the treatment and control groups got four caps of Fennel powder (2g) and four capsules of starch-containing capsules (2g), respectively. The menopause Kupperman index and the Hurlbert score of sexual desire were used to assess the participants' symptoms of menopause and sexual desire. The participants completed the questionnaires at the start of the trial, week four, and week eight. The levels of serum estradiol were measured at the beginning and end of the trial. The data was analyzed using the Chi-square test, independent t test, and repeat

measures descriptive analysis. The study found that using Fennel seed on a daily basis for 8 weeks dramatically alleviated symptoms of menopause in postmenopausal women (Ghaffari et al., 2020).

A review was led by Kasraeian et al. The purpose of this study was to see how an eight-week flexible fennel preparation affected PMS symptoms. It included 40 PMS-affected girls. It was arbitrarily divided into four sections: flexible preparation, flexible preparation, and control. Every week, versatile prepping was done three times for 45 minutes each session. It was ingested as orally administered 2 percent phenylene drops, Drops thirty, on a regular basis for a long time. Subjects were polled twice: once before the test and again after the test. The results showed that after more flexible preparation and fennel use, mental (8.011.26 vs 16.512.33) and physical (6.181.09 against 15.601.93) aspects of Pre - menstrual syndrome decreased when compared to the benchmark group (P0.05). It's possible that combining flexible cooking with the use of fennel could help to reduce the physical and psychological symptoms of PMS in young women (Kasraeian et al., 2021).

Khorshidi et al. led a study in which sixty people were chosen from a pool of total volunteers. The age range for the gathering was 17 - 25 years old with a normal. About a third of these people had second-grade essential dysmenorrhea, while the rest had third-grade. Fennel's main constituent, anethole, causes estrogen-wise movement in animals. It's possible that it's linked to people's fennel consumption and digestion, or to dysmenorrhea's obsessive wellspring. According to the current study, 67.5 percent of people get enough alleviation from pain after taking 2% fennel (Khorshidi et al., 2010).

A review was performed by Bokaie et al. This study looked at the effects of fennel drops on dysmenorrhea. It was a randomized trial with two groups of thirty participants each. The amount and intensity of menstrual bleeding did not differ significantly between the control and treatment groups. However, it was claimed that fennel could help with menstruation pain.  $P < 0.05$  was considered significant (Bokaie and Enjezab, 2017).

Nazarpour undertook a research project. It was a randomized, double-blind clinical experiment. A total of 104 students with moderate to severe dysmenorrhea were chosen and divided into three groups, each of which was given one of three drugs: Fennels (n=36), Mefenamic Acids (n= 36), or the placebo (n=32). When the pain started, these medications were administered to all of them for two menstrual cycles. When they first came in, they were asked to complete out a questionnaire about their menstrual history and pain. They were requested to keep track of their pain severity after taking the medicines in the first 5 hours of pain, 48 hours later, and two days later for two consecutive menstruation cycles. Among the many Fennel was reported to be a little more beneficial than the other two medicines in alleviating pain in women suffering from dysmenorrhea (Nazarpour and Azimi, 2017).

Another experiment involving 60 students compared the effects of fennel oil. Equal numbers of people were divided into two groups. The study group was one, while the placebo group was the other. They received given doses that were divided into thirds. For two cycles, it was given three days before and after menstruation. Fennel oil, 60 drops, was administered to them. Fennel has been reported to aid in the reduction of premenstrual symptoms (Mahboubi, 2019).

In 2012, a concentration in Kermaan, Iran, considered the efficacy of fennel seed and mefenamic in the treatment of primary dysmenorrhea discomfort. There were two groups of female adolescents, each with 50 participants (n=50). Fennel was shown to be 80 percent more effective in pain relief (Modaress, 2006).

The study was conducted on a clinical trial that involved 105 students with mild and moderate dysmenorrhea. The sample was then separated into four groups, each of which received extract of fennel, mefenamic acid, or placebo. The pain severity was measured using a visual analogue scale. One test was performed prior to the intervention and another was performed after the two rounds. All of the groups had similar demographic characteristics. There was no discernible change between the results of the tests conducted before and after the cycle. Fennel has the same effects on dysmenorrhea as vitagnous, although mefenamic acid is less efficient than these two medications (Zeraati et al., 2014)

Fennel's effect on the reduction of torment-related symptoms in essential dysmenorrhea was investigated in a review. This clinical progress over time included 105 Irbid Islamic Azad University residence understudies with critical dysmenorrhea who agreed to participate. 72 suitable people with degree three essential dysmenorrhea were identified and then randomly divided into two groups: test (Fennel) & control .3 to 5 drops of fennel, tea or water, were instructed for three consecutive cycles during exploratory gathering and the first three days of the period. For three days, the benchmark group received refined liquid case (control) four times each day. The data was collected using a five-section survey and analyzed using clear insights and the chi-square testing in SPSS version 17. The findings of this study revealed that there had been no significant difference in the symptoms of agony during the menstrual cycle between the test and control groups. Fennel was discovered to have the ability to reduce the adverse symptoms associated with agony in essential dysmenorrhea, such as headaches, fatigue, laxity of the stools, queasiness, and heaving, according to the research. It appears that this homegrown product can be used as a treatment for dysmenorrhea's basic symptoms (Motavalli., 2019).

Another review was conducted with the goal of determining the effects of fennel and Gelofen upon that severity of essential dysmenorrhea. Techniques: In 2016, this clinical trial was conducted on 72 understudies living in the dorms of the Islamic University of Ardabil. In two

meetings of fennel and Gelofen collectors, tests with grade 2 and 3 primary dysmenorrhea were deliberately isolated. During the first three days of the monthly cycle, the fennel bunch used 3-5 drops of fennel extract in water or tea 3 times each day, while the Gelofen bunch used the Gelofen bottle like clockwork. This technique was used in three cycles at each of the two events. A dysmenorrhea severity poll was included in the data collection device, which followed verbal multi-faceted rating standards. The data was analyzed using SPSS programming (version 17), as well as the t-test and chi-square tests. P 0.05 was thought to be a big number. Both fennel and Gelofen reduced the severity of pain from severe to mild to no pain, however there was no significant difference between the two groups of fennel and Gelofen in the progression of dysmenorrhea (p>0.05). The use of the two approaches for fennel & Glofen was effective in reducing the severity of essential dysmenorrhea, and pain reduction was comparable in the two groups. Due to the significant prevalence of dysmenorrhea in women, the use of fennel to treat dysmenorrheal is recommended (Motavalli and Shahbazzadegan, 2018).

A semi-experimental study was conducted on 90 women understudies at Ardabil University. Arbitrary examining was completed over the course of a half-year in 2013, with segment characteristics and a visual anguish scale serving as data collection equipment. For the information analysis, descriptive and analytical measurements were used. The findings of this study revealed that there had been a measurably significant link between signs of suffering before and after ingesting a spice combination (P=0.017). The findings of the study demonstrate that the use of spices (a blend of fennel, chamomile, and ginger) is effective in reducing dysmenorrheal symptoms. Given the significant prevalence of essential dysmenorrhea and Iran's potential within field of natural medicine, homegrown remedies are recommended for dysmenorrheal discomfort reduction alongside other medications (Samadi et al., 2015).

## CONCLUSION

According to the review study, based on current clinical evidence, fennel seeds have a promising function in the treatment and management of pain in primary dysmenorrhea and show a prominent impact with low side effects. It boosts the body's immunity and helps to control the menstrual cycle with less discomfort. It has positive effects on various elements of primary dysmenorrhea, although it has certain drawbacks, such as a limited sample size and short study duration. To examine their mechanisms and safety, more preclinical and clinical research with a bigger sample size and a more systematic methodology are required.

## CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

**AUTHOR CONTRIBUTIONS**

Momina Shahid designed and planned the research and also wrote the manuscript. Hifza Noor and Shahnai Basharat analyzed and interpret the data. Zainab and Breera helped in drafting the article. Hifza Noor critically revised the data All authors read and approved the final version.

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