Middle East Fertility Society Journal (2016) **21**, 61–64

Middle East Fertility Society

Middle East Fertility Society Journal

www.mefsjournal.org
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ORIGINAL ARTICLE

Comparing the effects of aerobic exercise and *Foeniculum vulgare* on pre-menstrual syndrome

Hassan Pazoki [a,*], **Golbano Bolouri** [b], **Farah Farokhi** [a], **Mohammad Ali Azerbayjani** [b]

[a] *Department of Biology, Faculty of Science, Urmia University, Urmia, Iran*
[b] *Department of Exercise Physiology, Islamic Aazad University, Tehran, Iran*

Received 28 January 2015; revised 19 June 2015; accepted 3 August 2015
Available online 8 September 2015

KEYWORDS

Aerobic exercise;
Foeniculum vulgare;
Premenstrual syndrome

Abstract *Introduction:* Premenstrual syndrome (PMS) has been identified by a number of psychological and physical symptoms which occur cyclically in the luteal phase of the menstrual cycle. The present study has been carried out to compare the effects of regular exercise and *Foeniculum vulgare* extract (fennel) together and separately on PMS in high school girls. *Materials and methods:* In this randomized clinical trial 48 students aged 16–18 years were selected by filling the daily record of severity of problem questionnaire (DRSP-Q). The participants were divided into four equal groups: the first group received fennel, the second group had aerobic exercise, the third group received fennel along with exercise and the last group was control group without fennel and exercise. Participants filled DRSP-Q three times: the first menstrual cycle before the intervention, the first menstrual cycle after four weeks and finally the first menstrual cycle after eight weeks of intervention. *Results:* After 8 weeks of intervention the severity of PMS symptoms reduced significantly in experimental groups (fennel, exercise and fennel + exercise) compared to control group ($P < 0.05$). Meanwhile, there were not any significant differences in age, body mass index, age at menarche, age at dysmenorrhea onset and duration of menstruation among the four groups. *Discussions:* The result of this study indicated that fennels and exercise could reduce the severity of premenstrual syndrome. In addition, fennel extract and exercise together seem to be more effective on symptoms of anxiety and depression compared with using them alone

1. Introduction

Premenstrual syndrome (PMS) has been identified with many physical and emotional symptoms during the luteal phase of menstrual cycle in young girls and middle aged women (1). It is estimated that more than 80% of women report having at least one or more PMS symptoms before menopause and the percentage of those who have definite syndrome is

* Corresponding author. Tel.: +98 9123148931.
E-mail address: hasan_fsh33@yahoo.com (H. Pazoki).
Peer review under responsibility of Middle East Fertility Society.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.mefs.2015.08.002

20–40% (2). The etiology of PMS remains unknown and some evidence suggests that hormone imbalance, ovary infection, deficiency of essential fatty acid, imbalances in prostaglandin as well as change in magnesium and calcium level in the serum can be considered as the main reasons for PMS (3–7). Meanwhile, impairment of renin–angiotensin–aldosterone pathway along with genetic and lifestyle seems to affect PMS symptoms (8,9). It is difficult to estimate the exact prevalence of PMS due to the variety of symptoms (10). There are two kinds of symptoms related to PMS, somatic and psycho-emotional symptoms. The common psycho-emotional and behavioral symptoms include restlessness, depression, anxiety, anger, confusion and loneliness. Breast tenderness and headache, low back pain, weight gain and blotting are major somatic symptoms (11,12). The PMS has a significant effect on the quality of life and family health cost. Furthermore, some studies have demonstrated that PMS causes reduction in women's work efficiency and leads to family and social relationship problems. Consequently, these problems necessitate finding an appropriate treatment for this syndrome (13,14). There are several treatments to ameliorate or eliminate the symptoms such as nonpharmacological treatments (reduction in salt intake and animal fat consumption, physical activity and herbal medicine) and pharmacological treatments (mefenamic acid, gamma linoleic acid and fluoxetine) (15,16).

In recent years, there has been a trend to use herbal medicine or aerobic exercise to treat PMS because there is no side effect for using these methods compared to medical treatments (17–19). *Foeniculum vulgare* (fennel) is an herb that is traditionally used for menstrual disorders (20). There are many evidences that show fennel has anti-inflammatory, anti-spasmodic, analgesic, diuretic and expectorant effects (21–23). Torkzahrani et al. reported that fennel extract reduced the severity of dysmenorrhea (24). Some studies have indicated that fennel extract is useful to reduce the frequency and intensity of contractions in rats (25). Moreover, for the first time some studies in 1938 showed that physical exercise also had positive effect on regulation of menstrual cycle and reproduction. In 1988, Gannon reported that physical exercise had potential role in the alleviation of menstrual disorders and menopausal symptoms (26,27). A study by Steege in 1993, showed that aerobic exercise had significant effects on reducing PMS symptoms compared to strength exercise (28). The purpose of the present study was to compare the effects of exercise and fennel against premenstrual syndrome in young girls.

2. Materials and methods

This clinical trial study has been carried out on 200 female high school students aged 16–18 years. The participants were requested to fill the daily record of severity of problem questionnaire (DRSP-Q) two cycles before intervention and then the severity of premenstrual syndrome was evaluated for all students. The DRSP-Q form is a standard tool for detecting the intensity of PMS and its validity and reliability has been approved by Borenstein et al. (26). This form determines the severity of PMS using five items, including anxiety symptoms (tension, emotional changes, irritation, reduction in concentration and fear), depressive symptoms (depression, hopelessness, amnesia, crying, dizziness, mood disorders, sleep disorders, isolation and loss of interest in daily activities), emotional symptoms (headache, sweating, hot-flushes, increased appetite, heart palpitation, fatigue, reduced energy, and inability to do the daily activities), fluid and electrolyte retention symptoms (increases in weight, edema, breast tenderness, backache, abdominal cramps and pain in muscles and joints), and somatic symptoms (acne, urinary frequency, constipation and inflammation of nose) (26). Based on the DRSP form, scores ranging from 0 to 4 were allocated to evaluate the severity of symptoms as follows:

0: absence of symptoms, 1: mild (the individual seldom has problems in daily activities), 2: moderate (the individual has problems in maintaining daily activities, but can go to work or school), 3: severe symptoms (the individual is not able to do daily activities) and 4: very intense (the individual is confined to bed) (29). Considering the purpose of the present study, 48 students with moderate and severe PMS were selected for the intervention. They were randomly assigned into four equal groups. The first group received aerobic exercise, the second group received fennel extracts, the third group received Fennel + exercise and the last group did not receive fennel or exercise as control group.

All participants were asked to fill DRSP questionnaire three times; 1 – the first menstrual cycle before the intervention, 2 – the first menstrual cycle after four weeks of aerobic exercise and using fennel and finally first menstrual cycle after eight weeks of intervention. The amount of the given fennel extracts was 30 drops, every 8 h, 3 days before until 3 days after the onset of menstrual bleeding. The fennel extract was obtained from the Bareej pharmaceutical company (BPC). The aerobic exercise program consisted of a ten-minute warm-up, 40 min of fast exercise in limb and trunk followed by 10 min cooldown.

2.1. Statistical analysis

Data were analyzed by ANOVA and paired T-test in SPSS (v. 16) and $p < 0.05$ was considered statistically significant.

3. Results

Clinical characteristics of participants such as BMI, age, height and weight have been shown in Table 1. As the data are shown in Table 1, no significant differences were observed for BMI, age at menarche, age at dysmenorrhea onset and duration of menstruation between four groups. In addition, menstrual cycle intervals and family history of PMS were similar among the groups and no student had any family illness.

The result in Table 2 demonstrates that fennel and aerobic exercise had positive effects on reducing the severity of PMS syndrome. The data in Table 2 showed, that after 4 weeks of intervention as well as the end of the study, the differences were significant in all experimental groups (fennel, exercise and fennel + exercise) compared to control group regarding reducing the severity of PMS syndromes ($P < 0.05$). Meanwhile, the results indicated that fennel along with aerobic exercise seems to be more effective in decreasing the severity of PMS symptoms rather than using each one separately.

4. Discussion

The results of this study demonstrate that herbal medicine like fennel and regular aerobic exercise have positive effects on reducing the severity of PMS symptoms in young women

Table 1 The demographic characteristics of participants regarding age, hight, weight and BMI.

	Group 1 Exercise (Average ± SD)	Group 2 Fennel (Average ± SD)	Group 3 Exercise + fennel (Average ± SD)	Group 4 Control (Average ± SD)
Age	16.87 ± 0.39	16.57 ± 0.32	17.12 ± 0.43	17.2 ± 0.27
Height	160.71 ± 2.75	159.71 ± 9.46	161.2 ± 3.2	158.61 ± 5.2
Weight	52.57 ± 7.82	52.42 ± 8.8	56.18 ± 9.51	55.18 ± 12.59
BMI	22.33 ± 2.7	20.91 ± 3.13	22.31 ± 2.35	21.31 ± 3.69

Fennel, *Foeniculum vulgare* – PMS, Premenstrual Syndrome – BMI, Body Mass Index.
Numbers are written by average ± Standard deviation.

Table 2 Results of PMS symptoms before, middle and at the end of intervention in 48 students with premenstrual syndrome symptoms.

PMS symptom	Exercise (Average ± SD)	Fennel (Average ± SD)	Exercise + fennel (Average ± SD)	Control (Average ± SD)
Before intervention	34.31 ± 16	33.27 ± 16	33.45 ± 12	33.36 ± 17
Middle of intervention	30.88 ± 17[a]	29.33 ± 17[a]	29.26 ± 76[a]	33.44 ± 18
After intervention	29.69 ± 16[a]	28.49 ± 16[a]	27.86 ± 45[a]	33.90 ± 17

Fennel, *Foeniculum vulgare* – PMS, premenstrual syndrome – (Average ± SD); Numbers are written by average ± Standard deviation.
[a] Significant differences compared to control group $P < 0.05$.

and this result confirms the previous studies about positive effects of aerobic exercise (8,9,30) and herbal medicine like fennel on PMS (31,32).

PMS which is defined by physical and behavioral symptoms is one of the most common disorders among women especially the younger one (33,34). In general, the symptoms of PMS begin at maturation age or 2 years post-menarche, and remain until menopause (14). More than 70% of women experience PMS symptoms to some extent before menses and women with moderate to severe symptoms need to be treated (14). There are different types of treatment around the world such as using herbal medicine, aerobic exercise, and using synthetic drugs or surgery and conflicting results have been reported, but up to now, there has not been any universally acceptable treatment for PMS (8,9,14,35). Herbal medicine and aerobic exercise could be a favorable therapeutic approach due to fewer side effects (29). As far as it is known, the effects of fennel and aerobic exercise together on premenstrual syndrome have not been studied yet. In the present study, the effects of fennel extract and aerobic exercise were investigated together and separately in PMS.

Many studies reported that medical plants could reduce the severity of PMS up to 50% (31,32,36). Fennel extract has been previously used to relieve dysmenorrhea related to PMS. The essence of fennel has inhibitory effects on prostaglandin E2 and oxytocin production (25) and some suggested reasons for PMS are imbalances in hormones and prostaglandin (3–7). Therefore, it seems that the method of fennel action on PMS is hormonal and the outcome of this study shows that fennel extract could be effective in relieving PMS symptoms.

Meanwhile, recently some studies were conducted to show the positive effect of aerobic exercise on PMS (37,38). Prior et al. also have demonstrated that regular aerobic exercise could decrease water retention and breast tenderness (36). In general, suggested reasons for electrolyte symptoms are deficiency of vitamin B6 and magnesium along with increased serum level of prostaglandin E2 and aldosterone (30). It has been demonstrated that aerobic exercise could reduce PMS symptoms by decreasing renin and increasing the level of progesterone and estrogen which lead to decrease in aldosterone (38). Furthermore, it has shown that the reason for breast tenderness and edema is the increased level of prolactin and exercise could reduce the prolactin level and accordingly the person feels better (30).

The finding of this study proves the previous research outcomes which shows that fennel extracts and exercise reduce the intensity of premenstrual syndrome in young women. The results show that fennel extract has more significant effects along with exercise. The data also demonstrate that fennel has more positive effects than exercise on PMS and after 8 weeks of intervention the severity of PMS was reduced in groups with fennel (fennel & fennel + exercise) (Table 2). The outcomes of this study showed that fennel and aerobic exercise could be used together as a good treatment for women with PMS.

5. Conclusion

Fennel extract and exercise together or separately reduced the severity of premenstrual syndrome. Fennel extract and exercise both were more effective on PMS symptoms of anxiety and depression. Further investigations with more participants and longer duration of therapy should be carried out to clarify the detailed benefits of fennel extract and aerobic exercise in women with PMS.

Conflict of interest

The authors declare that there are no conflicts of interest.

Acknowledgments

Special thanks to Mrs. Porsaeed the manager of Moallem high school, the students who participated in this study, and Kharazmi Institute of Research in Pakdasht City.

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