

Effects of Pilates and Vitamin E on Symptoms of Premenstrual Syndrome

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Background: Premenstrual syndrome (PMS) is a set of physical, emotional and behavioural changes that appear in the late luteal phase of the menstrual cycle. Given the high prevalence of this syndrome among women, this study aimed to evaluate the effects of Pilates Exercise and vitamin E consumption on symptoms of PMS.

Methods: In this semi-experimental study, 40 non-athletic female students with diagnosed moderate to severe PMS were selected from the University of Ayatollah Boroujerdi. The students were randomly divided into four groups of "Pilates, Pilates along with vitamin E, vitamin E and controls". Pilates workouts were performed for 4 weeks, three session a week with consumption of one vitamin E tablet a day. Subjects were analysed using the PMS symptoms screening questionnaire before and after the intervention. Analysis of variance and t-test were performed to compare the obtained data at significance level of $P < 0.05$.

Results: There was no significant difference between the four groups before the intervention. In the Pilates group and vitamin E group, the intensity of mood symptoms ($P=0.0001$) and physical symptoms ($P=0.002$), and the impact of these symptoms on individuals' lives ($P=0.0001$) reduced significantly in comparison with data before the intervention and the control group.

Conclusion: Pilates along with vitamin E consumption improves the symptoms of PMS among the participants of this study.

Keywords: Pilates, Premenstrual Syndrome, Vitamin E

Introduction

Cyclical nature of females' reproductive system is a natural part of their lives that are accompanied with subsequent physical and mental symptoms (1). Premenstrual syndrome (PMS) affects millions of women and is known as the most important disorder in women (2). This syndrome has a set of symptoms that occur during late luteal phase of the menstrual cycle (3). Physical symptoms include headaches, bloating, edema of extremities, breast tenderness, muscle and joint pain, fatigue, thirst, lack of energy and appetite change. Mental symptoms include anxiety, depression, anger or irritability for no reason, crying spells, difficulty in concentration, aggressiveness and suicidal tendencies (4,5). Khajehei et al. (2009) estimated that more than 90% of women in the reproductive age experience some of these symptoms before menstruation (6). Conducted studies in Iran reported the prevalence of this syndrome as 62.4% and 67.7%. This indicates that a majority of the female population suffers from this disorder (7). Since the cause of this syndrome is unknown, proposed treatments are different. Currently, no definitive treatment is available for the PMS (8). Treatment of this disease as a predictable and debilitating cyclical discomfort that has an important role in efficiency loss of women seems necessary (9). In this regard, suggested treatment methods include drug therapy (Mefenamic acid, anti-depression pills, etc.), surgery (oophorectomy) and non-drug and alternative therapies (physical activity, massage and behavioral therapy) (10).

Considering the side effects of surgical and drug treatments, non-drug therapies especially physical activity, has attracted the attention of specialists and women with this syndrome (9). Physical activity is an appropriate treatment method for the PMS and the best method for all women to reduce pressure and induce balance in the brain's chemical secretions. This activity improves the symptoms of PMS, increases pain tolerance and reduces anxiety and depression by increasing endorphins and reducing adrenal cortisol (8). Physical activity has beneficial effects on individuals' ability and increases their practical capacity. It also increases efficiency of the mind and promotes

vitality and health by causing a good attitude to life and providing mental health. Women are affected more by the psychological factors of physical activity compared to men and good feelings are increased more in them (11). Daley (2009) reported the effectiveness of physical exercise and proper nutrition in the treatment of PMS (9).

Pilates Exercise is one of the widely spread methods of movement therapy that has received attention in recent years. This exercise is a set of specific exercises and a combination of the two elements of body and mind. In this method, focus is on the center of the body including the abdominal area, hips and spine. The main purpose of this kind of training is to increase strength, flexibility, endurance, balance and fitness (12). Unlike the majority of other exercises that are focused on the physical aspect of an individual, Pilates focuses on the mental aspect simultaneously and is based on the harmony between body and mind (13). Pilates has six general principles: relaxation, concentration, precision, alignment, fluidity and breathing (14). This training method is performed in static positions (lying, sitting and standing) with no walking, jumping or leaping (15).

Eyigor et al. (2010) evaluated the effects of Pilates on level of fatigue, depression and quality of life of women with breast cancer over a period of rehabilitation and reported its positive impact (16). Omidali (2015) evaluated the effects of Pilates and consumption of fennel extract on PMS among students and showed the improvement of symptoms after the workouts (17). Nowadays, many women are willing to treat the symptoms using complementary and natural medicine (18). Vitamin E is another factor that has been proposed for the treatment of dysmenorrhoea. Reduced levels of progesterone in the luteal phase trigger the activity of degrading enzymes that leads to peroxidation of phospholipids and release of arachidonic acid. Since menstrual pain is accompanied with increased levels of prostaglandins, inhibition of prostaglandin synthesis is the most important goal in the treatment of dysmenorrhoea. The antioxidant property of vitamin E reduces peroxidation of

phospholipids and inhibits the release of arachidonic acid and its transformation into prostaglandin (19).

Given the high prevalence of PMS among women and girls, and the little research available on the effect of physical exercise along with vitamin supplements on this syndrome, this study aimed to evaluate the effects of Pilates and vitamin E on the intensity of PMS symptoms in non-athletic girls to promote women's health

Material and Methods

This was a case control, semi-experimental study with pre- and post-test approach. The subjects included all non-athlete female students at the University of Ayatollah Borujerdi with age range of 18-23 years that had chosen the general physical education course in the second semester of 2014-15. Initially, 260 students were assessed using the premenstrual symptoms screening tool (PSST).

The validity of the Iranian version of PSST questionnaire was assessed by Seyahbazy et al. (2011). The content validity ratio was reported as 0.7 and 0.8. In reliability testing of the questionnaire, Cronbach's alpha value of 0.9 was achieved (20). The questionnaire had 19 items consisting of two sections; the first section contained 14 items that evaluate mood, physical and behavioral symptoms. The second section had five items that evaluate the impact of these symptoms on the subjects' lives rated on a scale of 0-4 (not at all, mild, moderate and severe), scored from zero to three. For the diagnosis of moderate to severe PMS, three following conditions should have been met:

1. At least one moderate to severe answer for questions 1 to 4.
2. In addition to the previous question, four moderate to severe cases from question 1 to 14.
3. A moderate to severe case in the last final questions (the impact of symptoms on life (20)).

Inclusion criteria included the presence of PMS, lack of regular exercise during the past three months, consumption of any effective drugs for PMS and lack of specific diseases. Individuals with irregular menstrual cycles, cycle length of less than 22 days and more

than 30 days were excluded from the study. Then, 40 volunteers were randomly selected from the students with moderate to severe PMS as study subjects. After obtaining a careful history of menstrual cycle characteristics (amount and duration of menstrual bleeding, menstrual intervals, family history of PMS and use of medications to relieve symptoms), the subjects were randomly divided into four groups of 10 people. Written consent was obtained from all subjects.

In the next step, each student were divided into groups of Pilates, vitamin E, Pilates along with vitamin E and controls by simple randomization. At first, physical condition, height and weight of students were examined. Students were advised to take 1 x vitamin E tablet (100mg) daily for a month (from the beginning of the monthly cycle until the end of next period). The risk of complications was described for all the subjects and they were asked to visit a gynecologist (as project consultant) in case of any problems.

Pilates Exercise were performed for a period of 4 weeks, three times a week for 45 minutes in each session. The workouts included movements involving abs, hips, waist and legs that were done in three positions (sitting, standing and lying down) with no required special equipment on mattresses at the University gym. The control group performed no exercise and did not consume vitamin E. The questionnaire was once again completed by the participant 24 hours after the last session.

Data analysis was performed by SPSS-18 software. Shapiro-Wilk test was used to determine the normality of the data and then the data were analyzed using descriptive and inferential statistics. Descriptive statistics such as mean and standard deviation (SD) and inferential statistics such as T-test were performed to compare groups before and after the test. One way ANOVA and scheffé's post hoc test were used to compare variables in the four independent groups. P-value of less than 0.05 was considered as the statistical significance level.

Results

The age of participants ranged from 18-23 years. The mean \pm SD of age of participants

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was 19.3 ± 1.7 years in the exercise group, 18.5 ± 5.3 in the vitamin E group, 19.7 ± 1.6 in the Pilates along with vitamin E group and 19.7 ± 2 years in the control group. The result of analysis of variance and comparison of scores in the three categories of PMS symptoms before and after the test showed no statistical difference between the average of mood-behavioral symptoms ($p=0.581$), physical symptoms ($p=0.312$) and the impact of these symptoms on life of the individual ($p=0.217$), before the workouts and vitamin E consumption. However, after the workouts and vitamin E consumption, the intensity of mood-behavioral symptoms ($p=0.001$), physical symptoms ($p=0.003$) of PMS and the impact of these symptoms on individuals lives ($p=0.043$) showed statistically significant differences in the intervention group (table 1, 2 and 3). Moreover, there was a significant difference among the mood- behavioral and physical symptoms and the impact of these symptoms in the pre-test and post-test of Pilates group ($P<0.001$) (table 1). There were also significant differences among the mood-behavioral symptoms ($P=0.001$), physical symptoms ($P=0.001$) and the impact of these symptoms on an individual's life ($P=0.006$) in the pre-test and post-test of Pilates along with vitamin E group.

There were significant differences among the mood-behavioral symptoms ($P=0.0001$) and physical symptoms ($P=0.00148$) in the pre-test and post-test vitamin E group, but no significant difference was observed in the impact of these symptoms on an individual's life in this group ($P=0.193$).

There was no significant difference among the mood-behavioral symptoms ($P=0.553$), physical symptoms ($P=0.598$) and the impact of these symptoms on an individual's life ($P=0.272$) in pre-test and post-test of the control group. According to the results of Scheffe's test, Pilates alone and along with vitamin E significantly reduced the mood-behavioral symptoms and physical symptoms of PMS and their impact on a person's life compared with the controls and the vitamin E group ($P\leq 0.05$). Comparison of the physical symptoms in the Pilates group alone and along with vitamin E showed statistically significant differences ($P=0.030$) (Table 2). Overall, the results of 4-week Pilates along with vitamin E consumption showed a significant difference in the intensity of the PMS symptoms form pre-test to post-test in the intervention groups, while no difference was observed in the control group (Table 1).

Table 1: Comparison of the mean and SD of mood-behavioral and physical symptoms of PMS and the impact of these symptoms on an individual's life in the studied groups

| | | | ss | df | ms | f | P-value |
|---|-----------|----------------|---------|----|--------|-------|---------|
| Mood- Behavioral Symptoms | Pre-test | Between groups | 52/475 | 3 | 17/49 | 0/662 | 0/581 |
| | | Within groups | 951/50 | 36 | 26/431 | | |
| | | Overall | 1003/97 | 39 | | | |
| | Post-test | Between groups | 524/90 | 3 | 174/96 | 6/515 | 0/001 |
| | | Within groups | 952/20 | 36 | 26/45 | | |
| | | Overall | 1477/10 | 39 | | | |
| Physical Symptoms | Pre-test | Between groups | 14/90 | 3 | 4/96 | 1/23 | 0/312 |
| | | Within groups | 145/00 | 36 | 4/02 | | |
| | | Overall | 159/90 | 39 | | | |
| | Post-test | Between groups | 54/70 | 3 | 18/23 | 5/69 | 0/003 |
| | | Within groups | 115/20 | 36 | 3/20 | | |
| | | Overall | 169/90 | 39 | | | |
| Impact of the Symptoms on Individuals' Life | Pre-test | Between groups | 34/40 | 3 | 11/46 | 1/55 | 0/217 |
| | | Within groups | 265/20 | 36 | 7/36 | | |
| | | Overall | 299/60 | 39 | | | |
| | Post-test | Between groups | 77/47 | 3 | 25/82 | 3/01 | 0/043 |
| | | Within groups | 308/90 | 36 | 8/58 | | |
| | | Overall | 386/37 | 39 | | | |

Table 2: Results of the Scheffe's post hoc test

| Variable | Group I | Group J | Mean difference (I-J) | Std. Error | P-value |
|---|-----------------------|-----------------------|-----------------------|------------|---------|
| Mood-behavioral symptoms | Pilates | Pilates and vitamin E | -2/8000 | 2/36660 | 0/707 |
| | | vitamin E | -3/5000 | 2/3660 | 0/542 |
| | | Control | *-9/9000 | 2/5095 | 0/005 |
| | Pilates and vitamin E | Pilates | 2/8000 | 2/3660 | 0/707 |
| | | Pilates and vitamin E | -0/7000 | 2/3660 | 0/993 |
| | | Control | -7/1000 | 2/5059 | 0/063 |
| | vitamin E | Pilates | 3/5000 | 2/3660 | 0/542 |
| | | Pilates and vitamin E | 0/7000 | 2/3660 | 0/993 |
| | | Control | -6/4000 | 2/5095 | 0/110 |
| | Control | Pilates | *9/9000 | 2/5095 | 0/005 |
| | | Pilates and vitamin E | 7/1000 | 2/5095 | 0/007 |
| | | vitamin E | 6/4000 | 2/5095 | 0/110 |
| Physical symptoms | Pilates | Pilates and vitamin E | -0/6000 | 0/8206 | 0/910 |
| | | vitamin E | *-2/6000 | 0/8206 | 0/030 |
| | | Control | -2/5250 | 0/8703 | 0/054 |
| | Pilates and vitamin E | Pilates | 0/6000 | 0/8206 | 0/910 |
| | | vitamin E | -2/0000 | 0/8206 | 0/135 |
| | | Control | -1/9250 | 0/8703 | 0/200 |
| | vitamin E | Pilates | *-2/6000 | 0/8206 | 0/030 |
| | | Pilates and vitamin E | 2/0000 | 0/8206 | 0/135 |
| | | Control | 0/0750 | 0/8703 | 1/000 |
| | Control | Pilates | 2/5250 | 0/8703 | 0/054 |
| | | Pilates and vitamin E | 1/9250 | 0/8703 | 0/200 |
| | | vitamin E | 0/0750 | 0/8703 | 1/000 |
| Impact of the symptoms on individuals' life | Pilates | Pilates and vitamin E | 1/8000 | 1/2979 | 0/594 |
| | | vitamin E | -3/2000 | 1/2979 | 0/129 |
| | | Control | *-4/3000 | 1/3767 | 0/034 |
| | Pilates and vitamin E | Pilates | 1/4000 | 1/2979 | 0/762 |
| | | vitamin E | -1/8000 | 1/2979 | 0/594 |
| | | Control | 2/9000 | 1/3767 | 0/238 |
| | vitamin E | Pilates | 3/2000 | 1/2979 | 0/129 |
| | | Pilates and vitamin E | 1/8000 | 1/2979 | 0/594 |
| | | Control | -1/1000 | 1/3767 | 0/887 |
| | Control | Pilates | *4/3000 | 1/3767 | 0/034 |
| | | Pilates and vitamin E | 2/9000 | 1/3767 | 0/238 |
| | | vitamin E | 1/1000 | 1/3767 | 0/887 |

(*The mean difference is at 0.05 significance level)

Table 3: Comparison of the mean and SD of mood-behavioral symptoms and physical symptoms of PMS and impact of these two on individuals' lives in the study groups (t-test results)

| Variable | Group | Measuring time | Mean \pm SD | P-value |
|---|-----------------------|----------------|------------------|---------|
| Mood-behavioral symptoms | Pilates | Pre-test | 16/90 \pm 4/84 | 0/001 |
| | | Post-test | 7/60 \pm 5/16 | |
| | Pilates and vitamin E | Pre-test | 19/20 \pm 5/32 | 0/001 |
| | | Post-test | 10/40 \pm 3/33 | |
| | Vitamin E | Pre-test | 16/10 \pm 3/74 | 0/001 |
| | | Post-test | 11/10 \pm 4/48 | |
| | Control | Pre-test | 18/00 \pm 7/25 | 0/553 |
| | | Post-test | 17/50 \pm 7/83 | |
| Physical symptoms | Pilates | Pre-test | 4/20 \pm 0/91 | 0/001 |
| | | Post-test | 1/60 \pm 1/26 | |
| | Pilates and vitamin E | Pre-test | 4/30 \pm 1/59 | 0/001 |
| | | Post-test | 2/20 \pm 1/22 | |
| | Vitamin E | Pre-test | 5/60 \pm 3/27 | 0/048 |
| | | Post-test | 4/10 \pm 2/61 | |
| | Control | Pre-test | 4/25 \pm 1/83 | 0/598 |
| | | Post-test | 4/12 \pm 1/88 | |
| Impact of the symptoms on individuals' life | Pilates | Pre-test | 6/50 \pm 2/87 | 0/002 |
| | | Post-test | 3/20 \pm 2/52 | |
| | Pilates and vitamin E | Pre-test | 8/70 \pm 1/49 | 0/006 |
| | | Post-test | 4/60 \pm 3/16 | |
| | Vitamin E | Pre-test | 6/70 \pm 2/26 | 0/193 |
| | | Post-test | 6/40 \pm 2/45 | |
| | Control | Pre-test | 7/50 \pm 3/46 | 0/272 |
| | | Post-test | 5/25 \pm 3/53 | |

Discussion

The results of this study showed that Pilates alone and in combination with vitamin E reduced the intensity of physical symptoms and mood-behavior symptoms in students with PMS.

Vitamin E was also found effective in relieving pain and the physical symptoms in patients with PMS. These results are consistent with the results of some studies on the effects of vitamin E consumption on the intensity of PMS physical symptoms, including Shabbiri et al. (2014) that showed the positive effect of vitamin E in relieving muscle pain in patients with PMS (21). Pourmohsen et al. (2010) reported that simultaneous consumption of calcium and vitamin E reduces the severity of pain in women with PMS (22).

Kashanian et al. (2010) also showed that vitamin E can reduce pelvic pain in primary dysmenorrhea (23). For the first time in a study conducted in 1988, vitamin E was

injected to women with primary dysmenorrhea and the activity of beta-endorphins at the peak of pain during menstruation and 15 minutes after the injection was evaluated. The results showed that pain was reduced in all cases 15 minutes after the injection that was accompanied with significant increase in the beta-endorphin-like compounds, which is thought to be caused by the analgesic effects of vitamin E (23).

Reduction of the physical symptoms in the Pilates group can be linked to the possible mechanisms of Pilates Exercise in pain relief. In the present study, the positive effect of exercise on reducing the mood-behavioral symptoms was observed. The intensity of mood-behavioral symptoms reduced after 4 weeks of participation in Pilates Exercise alone and along with vitamin E consumption compared to the pre-test and control group. These results are in agreement with the studies that showed physical exercise

improves physical and psychological symptoms of PMS. For instance, Samadi et al. (2013) compared the effect of Pilates and aerobic exercise on symptoms of PMS in non-athletic girls and reported that performing Pilates Exercise and aerobic exercise is effective in reducing the intensity of PMS symptoms. However, the mean percentage of psychological symptoms and overall score of PMS were higher in the Pilates group compared with the aerobic group.

Omidali (2015) showed that 4 weeks of Pilates alone and along with consumption of fennel extract can reduce the intensity of physical and behavioral symptoms of PMS (17). Ghaedi et al. (2010) investigated the effects of aerobic interval training program, massage and their combination on the PMS symptoms and found that massage, aerobic training and their combination are nearly equally effective in reducing the symptoms (24).

In the study of Yekke Fallah et al. (2013), three months of physical exercise such as walking and aerobic exercise were highly effective in reducing pain, and decreased the physical and psychological symptoms of PMS. This indicates that the two methods of exercise are effective in improvement of physical and psychological symptoms and pain (25). Nikbakht (2006) also showed that 8 weeks of running and walking have a significant impact on reduction of PMS symptoms in female students (26).

Study of Abedy et al. (2013) demonstrated that endurance training can reduce the physical symptoms (27). Dehghan et al. (2008) confirmed the positive impact of three months of regular aerobic exercise on the intensity of physical symptoms and mood symptoms of PMS (10).

Mosalinejad et al. (2008) in a clinical trial showed that eight weeks of aerobic training significantly reduce the physical and emotional symptoms of PMS (28). The results of Valiani et al. (2013) demonstrated that 1 and 2 months of aerobic training is effective in reducing the symptoms of PMS, which confirms the findings of the present study (29). Safavi Naeini (2007) compared the effects of aerobic exercise and physical training on symptoms of PMS in women

living in Shiraz, and the results showed that exercise reduce the intensity of PMS symptoms, which is consistent with the present study findings (30). Eyigor et al. (2010) reported that Pilates Exercise can improve fatigue, depression and quality of life in women with breast cancer (16). Physical activity improves the symptoms of PMS by increasing endorphins and reducing adrenal cortisol levels (2,5). PMS Impairs communication and disrupts normal activities and affects the individual's lifestyle, comfort and health if the intensity of symptoms are high (32,33).

Its chronic negative effects cause escalation of conflicts in the family and disconnection between family members, reduce family sustainability and consequently reduce participation in family and social matters (34). Considering these issues, the present study evaluated the effect of PMS symptoms on individuals' lives and showed significant reduction in the symptoms of PMS and the impact of mood and physical symptoms interference with social and interpersonal relationships among the subjects in the Pilates group and Pilates along with vitamin E supplementation compared to the pre-test conditions and the controls. Regarding the impact of physical activity on individual and social relationships, Douglas (2002) found that women with higher activity level who exercise regularly face less physical and psychological symptoms compared to inactive women (35).

Conclusion

The effect of Pilates Exercise and vitamin E consumption on the physical and psychological symptoms of PMS in female students was evident. It can be concluded that all three methods (Pilates, vitamin E and Pilates along with vitamin E consumption) are effective in reducing the symptoms of PMS. However, Pilates is considered more effective because it is cost-effective, safe, accessible and enjoyable. For this reason, women with PMS should be encouraged to perform such exercises to improve their personal, occupational and social performance. Limitations of this study are as follows: subjects being single students and small sample size in each group.

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