



Effect of exercise on premenstrual symptoms: A systematic review

Havva Yesildere Saglam*, Ozlem Orsal

Eskisehir Osmangazi University, Faculty of Health Sciences, Department of Nursing, Eskisehir, Turkey



ARTICLE INFO

Keywords:

Premenstrual syndrome
Exercise
Premenstrual symptom
Systematic review

ABSTRACT

Introduction and purpose: The aim of this systematic review is to examine the effect of exercise on premenstrual symptoms.

Methods: In this systematic review, international databases (EBSCO Host, ScienceDirect PubMed, Google Scholar) were searched from the start of databases to 30 April 2018. Keywords used included “premenstrual syndrome” and “exercise”. For the keywords, “Medical Subject Headings” were used. Articles were screened by the two authors independently, and in case of disagreements, items were discussed until consensus was reached. All studies evaluating the effect of exercise on premenstrual symptoms were extracted from included studies without limiting the type of exercise.

Results: A total of 361 studies on the subject were examined, and 17 publications in accordance with the inclusion criteria were included in the study and evaluated. It can be said that exercise is effective in improving physical symptoms such as pain, constipation, breast sensitivity, and psychological symptoms such as anxiety and anger. However, although there is no clarity regarding other symptoms, exercise has a symptom-reducing effect.

Conclusion: Exercise is an effective intervention for alleviating premenstrual symptoms in women with premenstrual syndrome.

1. Background

Premenstrual syndrome (PMS) is a disorder characterized by emotional, physical and behavioral symptoms in women of reproductive age that increases the severity of the menstrual cycle during the luteal phase and spontaneously disappears within a few days after the onset of menstruation^{1–4}. More than 40 million women are reported to have PMS symptoms worldwide.⁵ While 20 % of women have symptoms that significantly affect their daily life, 90 % have mild premenstrual symptoms.⁶ More than 300 physical, psychological, emotional, behavioral and social symptoms have been shown to be associated with PMS.⁵ These symptoms include changes in appetite, weight gain, abdominal pain, back pain, low back pain, headache, swelling and tenderness in the breasts, nausea, constipation, anxiety, irritability, anger, fatigue, restlessness, mood swings and crying.^{7–10} Many non-pharmacological and pharmacological treatment methods are used to alleviate premenstrual symptoms.¹¹ Non-pharmacological treatment methods include physical activity and exercise, nutrition, herbal preparations, cognitive behavioral therapy and social support,¹² adequate rest, regular hot baths and vitamin supplements.^{9,13,14} These complementary and alternative therapies are reported to have mitigating effects on

symptoms.¹⁵ The American College of Obstetrics and Gynecologists recommends regular physical exercise as a drug-free treatment of PMS.¹⁶ Physical activity and exercise have beneficial effects on one's ability. It also increases the efficiency of the mind, the sense of happiness and health and provides a good attitude to life, providing mental health to people.¹⁷ Exercise also plays an important role in reducing stress, anger, depression, pain and the overall severity of premenstrual syndrome.^{17,18}

Exercise increases circulating endorphin levels (increases happiness), reduces adrenal cortisol for a short time and provides analgesic effect.^{16,17} Aerobic exercise is recommended for women with PMS because it reduces premenstrual mood symptoms.¹⁴ In a study, three-month aerobic exercise was reported to reduce premenstrual symptoms in sedentary women.¹⁶ Exercises such as walking, cycling, swimming and running are seen as a good way to suppress stress and eliminate premenstrual syndrome.¹⁷ Although there are studies examining the effect of exercise in the literature, there is no study that compiles the results of this study. It is important to evaluate the effect of alternative methods to reduce pharmacological treatments. In this context, the review was carried out with the aim of examining the effect of exercise on premenstrual symptoms and systematically reviewing the data

* Corresponding author at: Eskisehir Osmangazi University, Faculty of Health Sciences, Department of Nursing, 26040, Eskisehir, Turkey.
E-mail address: havvayesildere@gmail.com (H. Yesildere Saglam).

<https://doi.org/10.1016/j.ctim.2019.102272>

Received 19 August 2019; Received in revised form 1 November 2019; Accepted 26 November 2019

Available online 27 November 2019

0965-2299/ © 2019 Elsevier Ltd. All rights reserved.

obtained from the results of the study.

2. Methods

2.1. Design and eligibility criteria

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. All clinical trial studies (with or without a control group), quasi-experimental studies and cross-sectional studies that examined the effects of any exercise were included. The target population included women with premenstrual syndrome. Review and qualitative studies, non-English articles and non-full text articles were excluded. All articles were included without time restrictions.

2.2. Search strategy

The electronic databases were searched from the start of databases to April 30, 2018. These databases included PubMed, Google Scholar, EBSCO Host and ScienceDirect. Keywords used included “premenstrual syndrome” and “exercise”. The search strategy was prepared using the MESH (Medical Subject Headings) terms. Further details in regard with search strategies used for each database are as follows:

- EBSCOhost: “premenstrual syndrome”, “exercise” Refined by: Academic, Peer-reviewed Journals and Language: English
- Cochrane Library: “premenstrual syndrome”, “exercise”.
- Google Scholar: “premenstrual syndrome”, “exercise” [Title/Abstract]
- PubMed: “premenstrual syndrome”, “exercise” (full text articles)
- Science Direct: “premenstrual syndrome”, “exercise” [Title/Abstract]

For a quality assessment, articles were screened by the two authors independently, and in case of disagreements, items were discussed until consensus was reached. All potentially eligible studies and their corresponding full-text articles were retrieved and reviewed to determine whether they met the inclusion criteria. Details on the study selection process are reported in a flowchart (Fig. 1). There was no restriction in the assessment of physical and psychological symptoms. The exposure of interest was exercise, and the outcome of interest was PMS. Ethical approval was not required for this study since no primary data was being collected (Fig. 2).

The risk of bias for each included study was independently assessed by the two authors following the criteria of the Cochrane risk-of-bias tools and taking into consideration differences in study designs.

2.3. Selection of eligible studies

The researches included in the systematic review were conducted between 1993-2018. While reviewing the literature, there was no limitation in terms of the years covered. The full text of the researches, which were published in English, were included in the study. All studies included without limitation of exercise type and symptom type. Although the following studies were considered to be non-experimental, the content of the text was included in the study as it was consistent with the study criteria. (a) Although three studies were reported to be cross-sectional, exercise type and durations were reported.¹⁹⁻²¹ (b) One study was cross-sectional and prospective.²² (c) One study was identified as a preliminary study.²³

Duplicate articles, review articles, letters to editor and case reports were excluded from the systematic review. The abstracts of full articles were reviewed against the inclusion and exclusion criteria; any uncertainty regarding study eligibility was resolved by discussion among the first and the second authors.

3. Results

3.1. Study selection

A total of 361 articles were retrieved from the search of databases: 179 from EBSCO Host, 135 from PubMed, 33 from Google Scholar, 16 from ScienceDirect and 1 from Cochrane Library. Of the 304 non-duplicated studies in the title and abstract screening process, 278 were excluded because they had unrelated titles and abstracts. Of the remaining 26 studies, since PMS symptom assessment was not performed in 5 studies, 4 were not included in the scope of the study.

3.2. Study characteristics

A total of 17 studies that were carried out on 8817 women entered the research. Findings in terms of author, research aims, sample, measurement tools used, type and duration of exercise and types of research are given in the Table 1.

3.3. Type of interventions and procedures

Aerobic exercise was applied in 10 studies,^{17,19,22-29} fitness in one study,³⁰ Pilates in one study,³¹ swimming in one study,¹⁶ yoga in one study³² and Baduanguin exercise in one study.³³ No type of exercise was reported in 2 studies^{20,21} (Table 1).

Exercise was evaluated for 3 months in 8 studies,^{16,22,23,25,26,29,30,32} 2 months in 3 studies^{17,27,28} and 1 month in 2 studies.^{20,31} In 3 studies that included regularly exercising women, the duration was not specified,^{19,21,24} and in one study, the duration was taken as 3 menstrual cycles.³³

P-Population	All women with a premenstrual syndrome.
I- Intervention	Exercise regardless of type and duration. (aerobic exercise, swimming, pilates etc.)
C-Comparison	All types of comparison.
O-Outcomes	All relevant premenstrual symptoms. (physical symptoms, psychological symptoms.)
S-Study Type	All study types

Fig. 1. PICOS criteria for inclusion and exclusion of studies.

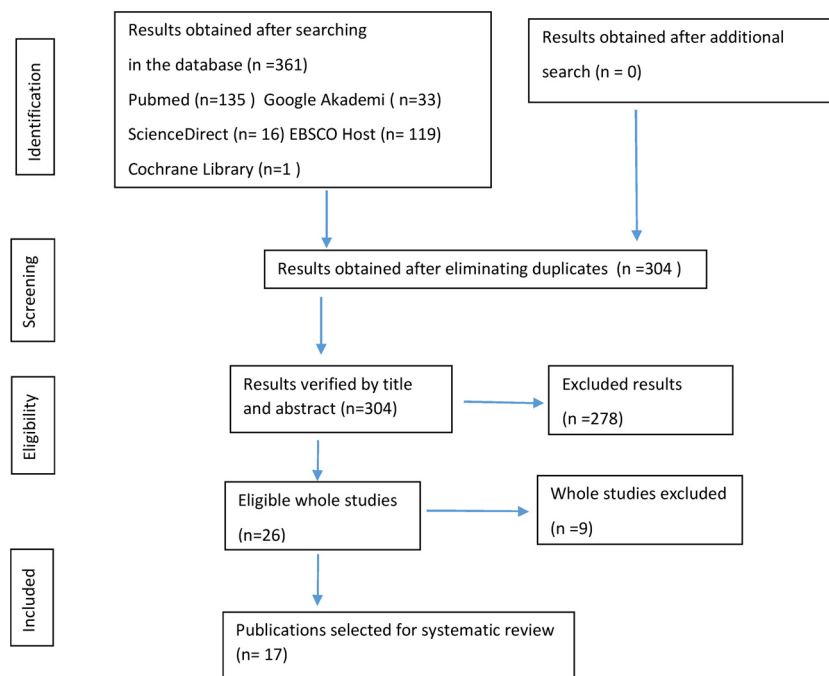


Fig. 2. Study selection process.

Exercise durations were not specified in 7 studies, while exercise duration was variable in others. At least 20 min and 90 min of exercise were used in each session (Table 1).

3.4. Effect of exercise on premenstrual symptoms

Premenstrual symptoms were examined in two groups as physical and psychological symptoms. All the symptoms encountered are given in Table 2. Table 2 shows the relationship between exercise and psychological and emotional symptoms of PMS. In the literature, PMS psychological symptoms are named differently, and the symptoms are grouped as emotional, mental and psychological symptoms and anger. Table 3 evaluates the relationship between exercise and the physical symptoms of PMS. The 17 studies included in this systematic review investigated the effect of exercise on commonly experienced premenstrual symptoms.

Exercise has been shown to have a positive effect on improving psychological symptoms, such as anxiety (n = 6),^{16,19,20,22,25,26} anger (n = 5),^{17,20,23,24,26,29} irritability (n = 6),^{17,20,21,23,26,29} worry and tension (n = 3),^{16,22,29} dizziness (n = 2),^{20,29} impairment of concentration (n = 4),^{16,22–24} crying (n = 3)^{16,17,32} and depression (n = 6).^{16,20,21,23,25,29} Other symptoms encountered are given in Table 2.

There are five studies indicating that exercise has a positive effect on physical symptoms without evaluating them separately.^{27,28,30,31,33} Exercise been shown to have a positive effect on improving physical symptoms, such as pain (n = 5),^{16,20,22,24,29} headache (n = 6),^{16,20–22,26,29} fatigue (n = 4),^{16,20,23,29} bloating-fluid retention (n = 7),^{20,22,23,25,26,29,32} breast sensitivity (n = 6),^{16,20,22,26,29,32} muscle cramps (n = 5)^{16,20,22,25,32} desire to eat (n = 5)^{20,23,25,26,29} and weight gain (n = 3)^{22,26,29} Other physical symptoms encountered are given in Table 2.

4. Discussion

A total of 17 studies were reviewed and included 8817 women. The studies included effect of exercise such as aerobic exercise, yoga, swimming and Pilates on premenstrual symptoms. Results from this systemic review demonstrate that regardless of the type of exercise,

regular exercise appears to be effective in relieving symptoms. Exercise cannot be said to be effective in reducing all symptoms of PMS at the same time. However, it can be said that exercise is effective in improving pain, constipation, breast sensitivity, and psychological symptoms in anxiety and anger. However, there is no clarity for other symptoms. It is stated that exercise will be effective in combating PMS symptoms and that there is no consensus on which type of exercise is more effective. In the literature related to exercise types, yoga, Pilates, swimming and aerobic exercises were practiced. Since exercise types seem to have similar effects on symptoms, it is thought that individuals may be offered the right to choose. However, it is suggested that participating in long-term regular exercise programs will be more beneficial in coping with PMS. For example, regular low and moderate aerobic exercises using large muscle groups 15–30 min a day, 3 times a week, 10 weeks or more provide improvement in PMS symptoms.¹⁶ In this systematic review, the effect of exercise on psychological symptoms will be discussed in the first part, and the effect of exercise on physical symptoms will be discussed in the second part.

4.1. Effect of exercise on psychological symptoms

Aerobic physical activity increases endorphin levels and reduces estradiol and other steroid hormones. It improves oxygen transport in muscles, reduces cortisol levels and is effective on psychological well-being.²⁰ In fact, the physiopathological mechanism of the physical symptoms of PMS can be explained more clearly, whereas the physiopathological mechanism of its psychological symptoms is not clear. In this context, it was not a standard in the assessment of psychological symptoms and was handled differently in each study.

Exercise and physical activity have been reported to reduce both anxiety^{16,19,20,22,25,26} and anger in the premenstrual period in all studies.^{17,20,23,24,26,29} Exercise appears to have a positive effect on mood^{17,20} and behavior changes.^{22,24} Exercise has been found to be effective in reducing psychological symptoms,^{28,30} emotional symptoms³¹ and mental symptoms in general without separate symptoms.^{27,33} Loneliness was evaluated only in two studies, where one reported positive effects of exercise on loneliness,¹⁷ and the other reported no effect.²⁶ Irritability was evaluated in eight studies; six studies indicate that exercise reduces irritability in the premenstrual period,^{17,20,21,23,26,29} and

Table 1
Description of the study characteristics, measurement and interventions.

First Author (Year)	Study Design	Sample Size	Purpose of the Study	Outcome Measures	Interventions
Steege, J. F. (1993)	A Preliminary Study	23 premenopausal women Aerobic exercise:12 Strengthening exercise: 11	To examine the relationship between aerobic exercise-strengthening exercise and premenstrual symptoms	Menstrual Symptom Questionnaire	3-month aerobic and strengthening exercise program (one hour three times a week)
Aganoff, J. A. (1994)	Unspecified	265 women EG:97 (15–48 age) CG:159 (16–51 age)	Examine the effects of regular exercise on mood and menstrual symptoms	Menstrual Distress Questionnaire (MDQ), Differential Emotions Scale (DES-IV)	Regular aerobic exercise at least 5 hours per week
Kirkby, R. J.(1998)	Cross-sectional Study	39 women (19–40 age) Exercise group:19 Sedentary group: 20	Examine the effect of exercise on anxiety and premenstrual symptoms	Modified Menstrual Distress Questionnaire, Tate-Trait Anxiety Inventory	Aerobic exercise at least 3 times a week
Stoddard, J. L. (2007)	Cross-sectional and prospective study	54 women (24–33 age) Exercise group:20 Sedentary group: 34	To examine the relationship between aerobic exercise and premenstrual distress and hormone levels	Moos Menstrual Distress Questionnaire	3 to 6 hours of aerobic exercise per week for the previous 3 months
Ghanbari, Z. (2008)	Quasi-experimental study	91 women(16-48age) EG:43 CG:48	To determine the effect of 3-month regular aerobic exercise on premenstrual symptoms	Modified Menstrual Distress Questionnaire (WIMDO)	3 months - 3 times a week - 60 min aerobic exercise
Koushkie Jahromi, M. (2008)	Single group quasi-experimental study	243 student (20.14 + 4.76 age)	To evaluate the effect of exercise on menstruation, dysmenorrhea, oligomenorrhea, amenorrhea and PMS symptoms (physical and psychological)	Moos Menstrual Distress Questionnaire (MDQ)	3 months - 2 times a week – 90 min fitness exercise
Tonekaboni, M. (2012)	Quasi-experimental study	90 women High intensity exercise: 30 Medium intensity exercise:30 CG:30	To evaluate the effect of regular aerobic exercise on clinical symptoms of PMS	PMS measurement - ACOG criteria, PMS likert Scale	3 months - 3 times a week – 50 min aerobic exercise
Samadi, Z. (2013)	Quasi-experimental study	40 kiz student (18–25 age) EG: 20 CG: 20	Evaluating the effects of 8 weeks of regular aerobic exercise on PMS	PMS measurement, DSM IV, Beck Depression Inventory, Beck Anxiety Inventory	2 months - 3 times a week, 60 min aerobic exercise
Zhang, H. (2014)	Clinical study	40 women (18–37 age) no experimental-control group	To investigate the effect of traditional Chinese medical exercise Baduanjin on improving PMS symptoms in women	Daily record of severity of problems (DRSP)	3 menstrual cycle - five times a week - twice a day - twice each time
El-Lithy, A. (2015)	Experimental study	30 women (16–20 age) EG:15 CG: 15 (Vitamin B6 and Ca supplementation)	To investigate the effect of aerobic exercise on premenstrual symptoms, hematologic and hormonal parameters in young women	A premenstrual syndrome questionnaire (MSQ)	Aerobic exercise 3 times a week - 3 months
Jafarnejad, F. (2016)	Randomized Controlled Study	65 students (20–40 age)	To determine the effect of aerobic exercise program on premenstrual syndrome in women with hot and cold temperament	Beck depression, Daily record of premenstrual syndrome symptoms, Borg Scale	2 months - 3 times a week - 20 min aerobic exercise
Omidali F.(2016)	Quasi-Experimental Study	40 women (4 group) Pilates + Vitamin E: 10 CG:30	To evaluate the effect of pilates and vitamin E consumption on PMS symptoms	PMS symptoms screening questionnaire	1 month-3 times-45 min pilates exercise
Tsai S.Y. (2016)	Yoga intervention study	64 women	To examine the relationship between yoga exercise and premenstrual symptoms	Self-Reported Premenstrual Symptoms Questionnaire, Short-Form 36-Item Health Survey	3 months - 2 times a week - 50 min yoga exercise
Mohebbi-Dehnavi, Z. (2017)	Experimental study	65 student (20–40 age) EG:35 CG:30	To determine the effect of regular 8-week aerobic exercise program on psychological symptoms of premenstrual syndrome	Daily symptoms of premenstrual syndrome, Overall profile and characteristics of the participants	2 months - 3 times a week - 20 min aerobic exercise
Kroll-Desrosiers, A.R. (2017)	Cross-sectional study	41.4 women (18–31 age) 41.4 women 80 PMS group: 80 Non PMS: 89	To investigate the relationship between physical activity and PMS and PMS symptoms	Calendar of Premenstrual Experiences	Options ranging from 0min-1.1 + hours per week in the last month
Maged, A. (2018)	Randomized Controlled Study	70 women EG:35women CG:35 women	To investigate the effect of swimming on the severity of premenstrual syndrome symptoms	Daily Symptoms Report	3 months - 3 times a week -30 min swimming exercise
Tsai, S. Y.(2018)	Cross-sectional study	7193 women (18–55 age)	To examine the prevalence of premenstrual symptoms and the relationship between regular exercise and premenstrual symptoms	Self-Reported Premenstrual Symptoms	No interventionRegular exercise (at least once a week)

Table 2
The effect of exercise on psychological symptoms.

Psychological and Emotional Symptoms	Steege, J. F. (1993)	Aganoff, J. A. (1994)	Kirkby, R. J. (1998)	Stoddard, J. L. (2007)	Ghanbari, Z. (2008)	Koushkie Jahromi, M. (2008)	Tonekaboni, M. (2012)	Samadi, Z. (2013)	Zhang, H. (2014)	El-Lithy, A. (2015)	Jafarnejad, F. (2016)	Omidali, F. (2016)	Tsai S.Y. (2016)	Mohebbi-Dehnavi, Z. (2017)	Kroll-Desrosiers, A. R. (2017)	Maged, A. (2018)	Tsai, S. Y. (2018)
Anxiety	-	-	→	→	→	-	-	-	-	→	-	-	-	-	→	→	-
Anger	→	→	-	-	→	-	→	-	-	-	-	-	-	→	-	-	-
Desire to be alone	-	-	-	-	Ineffective	-	-	-	-	-	-	-	-	→	-	-	-
Irritability	→	-	-	-	→	-	→	-	-	-	-	-	Ineffective	→	-	Ineffective	→
Mood changes	-	-	-	-	-	-	-	-	-	-	-	-	→	→	-	-	-
Worry, tension	-	-	-	→	-	→	→	-	-	-	-	-	Ineffective	→	-	→	-
Dizziness	-	-	-	Ineffective	-	-	→	-	-	-	-	-	Ineffective	→	-	-	Ineffective
Concentration disorder	→	→	-	→	-	-	→	-	-	-	-	-	Ineffective	-	→	→	-
Confusion	-	-	-	-	-	-	-	-	-	-	-	-	Ineffective	-	→	→	-
Crying	-	-	-	-	-	-	-	-	-	-	-	-	-	→	→	→	Ineffective
Depression	-	-	-	-	-	-	→	-	-	→	-	-	Ineffective	→	→	→	→
Forgetfulness	-	-	-	-	-	-	-	-	-	-	-	-	-	→	-	-	-
Emotional hypersensitivity	-	-	-	-	-	-	-	-	-	-	-	-	-	→	-	-	-
Emotional instability	-	-	-	-	-	-	-	-	-	-	-	-	-	→	-	-	-
Behavior change	-	→	-	→	-	-	-	-	-	-	-	-	-	-	-	-	→
Psychological symptom	-	-	-	-	→	-	-	→	-	-	-	-	-	-	-	-	-
Emotional symptoms	-	-	-	-	-	-	-	-	-	-	-	→	-	-	-	-	-
Mental symptoms	-	-	-	-	-	-	-	-	→	-	→	-	-	-	-	-	-

Table 3
Effect of exercise on physical symptoms.

Physical Symptoms	Steege, J. F. (1993)	Aganoff, J. A. (1994)	Kirkby, R. J. (1998)	Stoddard, J. L. (2007)	Ghanbari, Z. (2008)	Koushkie Jahromi, M. (2008)	Tonekaboni, M. (2012)	Samadi, Z. (2013)	Zhang, H. (2014)	El-Lithy, A. (2015)	Jafarnejad, F. (2016)	Omidali, F. (2016)	Tsai S.Y. (2016)	Mohebbi-Dehnavi, Z. (2017)	Kroll-Desrosiers, A. R., (2017)	Maged, A. (2018)	Tsai, S. Y. (2018)
Physical symptoms	-	-	-	-	-	→	-	→	→	-	→	→	-	-	-	-	-
Somatic disorders	-	-	-	-	-	-	-	-	-	-	-	-	Ineffective	-	-	-	→
Pain	-	→	-	→	→	-	→	→	-	-	-	-	-	→	→	→	-
Headache	-	-	-	→	→	-	→	→	-	→	-	-	Ineffective	→	→	→	→
Back pain	-	-	-	-	-	-	→	→	-	→	-	-	Ineffective	-	-	-	→
Fatigue	→	-	-	-	-	-	→	→	-	-	-	-	Ineffective	→	→	→	-
Sleep problems	-	-	-	-	→	-	→	→	-	-	-	-	-	→	→	Ineffective	-
Bloating - fluid retention	→	Ineffective	-	→	→	-	→	→	-	→	-	-	→	→	→	Ineffective	Ineffective
Breast sensitivity	-	-	-	→	→	-	→	→	-	-	-	-	→	→	→	→	-
Cramps	-	-	-	→	-	-	-	-	-	→	-	-	→	→	→	→	Ineffective
Muscle stiffness	-	-	-	→	-	-	-	-	-	-	-	-	Ineffective	-	-	-	Ineffective
Desire to eat	→	-	-	→	→	-	→	→	-	→	-	-	-	→	→	→	-
Weight gain	-	-	-	→	→	-	→	→	-	-	-	-	Ineffective	-	-	-	Ineffective
Diarrhea	-	-	-	-	Ineffective	-	-	-	-	-	-	-	Ineffective	→	→	→	→
Constipation	-	-	-	-	-	-	→	-	-	-	-	-	→	→	→	→	→
Nausea-vomiting	-	-	-	-	Ineffective	-	-	-	-	-	-	-	-	→	→	→	Ineffective
Hot flashes	-	-	-	→	-	-	-	-	-	-	-	-	Ineffective	→	→	→	Ineffective
Sweating	-	-	-	Ineffective	Ineffective	-	-	-	-	-	-	-	→	→	→	→	Ineffective
Palpitation	-	-	-	-	Ineffective	-	→	→	-	-	-	-	Ineffective	→	→	→	Ineffective
Skin changes, allergy, itching, acne	-	-	-	→	Ineffective	-	→	→	-	-	-	-	Ineffective	→	→	→	Ineffective

two studies report no effect.^{16,32} There are five studies examining the effect of exercise on anxiety and tension, while three studies reported that exercise reduced anxiety and tension,^{16,22,29} but not the other two.^{17,32} There are six studies examining the effect of exercise on dizziness; four studies reported that exercise did not affect dizziness,^{17,21,22,32} and two studies reported that dizziness was decreased.^{20,29} Concentration disorder was evaluated in six studies; four showed a decrease in concentration impairment with exercise,^{16,22–24} but not the other two.^{17,32} There are three studies evaluating the effect of exercise on confusion. Among these, two reported a positive effect of exercise on confusion-confusion reduction,^{16,20} while one reported no effect.²¹ There are five studies evaluating the effect of exercise on crying among premenstrual symptoms. Exercise reduces crying in three studies,^{16,17,32} but has no effect in two studies.^{20,21}

Physical activity increases the amount of progesterone and balances the levels of estrogen and progesterone, thereby reducing psychological symptoms.¹⁷ There are eight studies examining the effect of exercise on depression in the premenstrual period. Six studies reported that exercise reduced depression,^{16,20,21,23,25,29} and two studies reported no effect.^{17,32} Two studies examined the effect of exercise on forgetfulness and tenderness; one reported a decrease in forgetfulness,¹⁷ and the other reported no effect.²⁰ There are two studies examining emotional instability. One of them reports reduced emotional instability,²¹ and the other reports no effect.³²

After exercise, anxiety, depression and mood changes occur with endorphins and monoamine substances. Exercise helps raise body temperature, improves brain circulation and affects the hypothalamo-pituitary-adrenal axis. Regular aerobic exercise is expected to help reduce sympathetic response and hypothalamo-pituitary-adrenal axis reactions and thus reduce anxiety.¹⁶ However, as shown in Table 2, the effect of exercise on the psychological symptoms of PMS, including loneliness, irritability, anxiety tension, dizziness, concentration disorder, confusion, crying, depression, forgetfulness, tenderness and emotional instability is unclear. The reasons for this are non-standard symptoms, use of different measurement tools, variability of exercise time, study of a different population-sample, and so on. In this context, it is thought that standardizing and evaluating the symptoms in the studies will provide more accurate results.

4.2. Effect of exercise on physical symptoms

During aerobic exercise, venous return increases with repetitive muscle contractions. Increased venous return increases substances such as prostaglandins that reduce back pain and abdominal and pelvic discomfort. Decreased norepinephrine levels as a result of regular exercise helps reduce both heart rate and blood pressure at rest.^{16,34} It has been reported in the literature that exercise helps reduce muscle cramps and stress by improving circulation. Otherwise, stress tends to increase sympathetic activity and may exacerbate uterine contraction and increase menstrual pain. Exercise is known to alleviate sympathetic activity, pain, stress and premenstrual symptoms due to the release of endorphin, substances produced by the brain, and increase the pain threshold.³⁴

There are five studies indicating that exercise has positive effects on physical symptoms without separately symptom assessment.^{27,28,30,31,33} Two studies have evaluated the effect of exercise on somatic disorders from premenstrual symptoms; one reported a decrease in somatic disorders after exercise,²¹ and the others reported no change.³² Pain was evaluated as general pain, headache and back pain in the studies. There are five studies evaluating the effect of exercise on pain in the premenstrual period, and it has been reported that pain is reduced as a result of exercise in all studies.^{16,20,22,24,29} Headache was evaluated in seven studies; in six studies, headache decreased as a result of exercise^{16,20–22,26,29} and one study reported no change.³² Back pain was evaluated in four studies. three reported decreased back pain as a result of exercise,^{21,25,29} and one study reported no change.³² According to the

results of the study, exercise is a good way to alleviate pain. However, in one study, it was stated that exercise was not effective on back pain and headache. It is important to evaluate the effects of exercise types on premenstrual symptoms in more comprehensive and advanced studies. According to the results of the study, exercise is a good way to alleviate pain. However, in one study, it was stated that exercise was not effective on back pain and headache. It is important to evaluate the effects of exercise types on premenstrual symptoms in more comprehensive and advanced studies. There are five studies evaluating the effect of exercise on fatigue during the premenstrual period. According to the results of this study, exercise reduced fatigue in four studies,^{16,20,23,29} with no change observed in one study.³² There are four studies examining the effect of exercise on sleep; three them reported positive improvements in sleep disorders as a result of exercise,^{20,26,29} and one reported no change.¹⁶

In the premenstrual period, cyclical changes in sex hormones, bloating and fluid retention occur. Muscle contractions during exercise allow the release of fluid that causes bloating or tenderness. In this way, improvement of exercise circulation also provides better absorption of excess fluid.¹⁶ There have been ten studies evaluating bloating and fluid retention. Seven of these studies showed signs of bloating and fluid retention as a result of exercise,^{20,22,23,25,26,29,32} with three studies found no effect.^{16,21,24} Similarly, there are six studies evaluating breast tenderness as a result of bloating and fluid retention; in all studies, exercise has been shown to be effective in reducing breast sensitivity.^{16,20,22,26,29,32}

It has been reported in the literature that exercise helps reduce muscle cramps by improving circulation.³⁴ The effects of exercise on muscle cramps were examined in six of the studies included in the review. Five studies found that exercise was effective in reducing muscle cramps,^{16,20,22,25,32} and one found no effect.²¹ There are also three studies evaluating muscle stiffness; one study reported that exercise reduced muscle stiffness,²² and two studies reported no effect.^{21,32}

Premenstrual period is a process where many psychological symptoms occur. It has been reported that psychological changes that occur during this process are related to eating desire and eating behaviors.³⁵ Eating desire was examined in six studies. Five studies reported decreased desire to eat as a result of exercise,^{20,23,25,26,29} and one study reported no effect.¹⁶ The desire to eat in this process also causes weight gain. Weight gain was evaluated in five of the studies examined; three studies showed that exercise reduced weight gain,^{22,26,29} while two studies reported no effect.^{21,32} In the premenstrual period, diarrhea and constipation complaints can be seen in women. Diarrhea was examined in four studies. Two studies report that exercise decreases the occurrence of diarrhea in the premenstrual period,^{20,21} while two studies reported no effect.^{26,32} Constipation was studied in four studies; in all studies, exercise was found to reduce constipation in the premenstrual period.^{20,21,29,32} There are three studies examining the effect of exercise on nausea and vomiting complaints; two reported no effect on nausea and vomiting,^{21,26} but in one study it was found to reduce.²⁰ There are four studies examining the effect of exercise on the complaints of hot flashes occurring during the premenstrual period. In two of these studies, exercise was found to be effective in reducing the complaints of hot flashes,^{20,22} but not in two.^{21,32} Sweating has been evaluated in four studies; One study found that exercise reduced sweating,³² and three studies found no effect.^{21,22,26} Palpitations were examined in five of the studies; in two, palpitation complaints decreased as a result of exercise,^{20,29} and in three studies, there was no effect on palpitation complaints.^{21,26,32} Skin changes were examined in six studies. In three of the studies, exercise decreased the occurrence of skin changes,^{20,22,29} but was not effective in three studies.^{21,26,32} The results of the study show that exercise is effective in improving the physical symptoms of PMS.

5. Limitations

Included studies involved a large number of participants, were at unclear-to-high risk of bias, and were highly heterogeneous in terms of study design and characteristics of intervention (exercise type and duration). Due to the different affects of these interventions and different exercise type and duration, findings from that study are prone to bias. Although all efforts were made to retrieve all relevant data, the articles whose publication language is not English and the full text is not available for could not be reached. Therefore, publication bias cannot be excluded.

6. Conclusion

A total of 17 studies (1993–2018) that were carried out on 8817 women (min.23 - max.7193) entered the research. Exercise types and duration vary in studies. However, regardless of the type of exercise, it can be said to be effective in improving symptoms (physical and psychological symptoms). Given the limited number of articles in this area, further studies are also suggested into the effects of exercise on women. It is thought that using appropriate measurement tools and evaluating symptoms separately will provide more accurate results. In particular, further studies are needed to address the psychological symptoms of exercise. It is also recommended that further studies address the impact of different exercise types on PMS. Standardization of exercise programs by opening polyclinics for women with premenstrual syndrome in obstetrics and gynecology clinics, referring women with premenstrual symptoms to an exercise program of interest and conducting studies on the risk of bias of individuals are recommended, along with meta-analysis studies on the subject.

References

- Walsh S, Ismaili E, Naheed B, O'Brien S. Diagnosis, pathophysiology and management of premenstrual syndrome. *Obstet Gynaecol*. 2015;17(2):99–104.
- Ju H, Jones M, Mishra GD. Premenstrual syndrome and dysmenorrhea: Symptom trajectories over 13 years in young adults. *Maturitas*. 2014;78(2):99–105.
- Ryu A, Kim T-H. Premenstrual syndrome: a mini review. *Maturitas*. 2015;82(4):436–440.
- Qiao M, Zhang H, Liu H, et al. Prevalence of premenstrual syndrome and premenstrual dysphoric disorder in a population-based sample in China. *Eur J Obstet Gynecol Reprod Biol*. 2012;162(1):83–86.
- Ezeh O, Ezeh C. Prevalence of premenstrual syndrome and coping strategies among school girls. *Afr. J. Psychol. Stud. Soc. Issues*. 2016;19(2):111–119.
- Yesildere Saglam H, Basar F. The relationship between premenstrual syndrome and anger. *Pak J Med Sci*. 2019;35(2):515.
- Chandraratne NK, Gunawardena NS. Premenstrual syndrome: the experience from a sample of Sri Lankan adolescents. *J Pediatr Adolesc Gynecol*. 2011;24(5):304–310.
- Delara M, Borzuei H, Montazeri A. Premenstrual disorders: prevalence and associated factors in a sample of Iranian adolescents. *Iran Red Crescent Med J*. 2013;15(8):695.
- MAE-R Elnagar, HAEM Awed. Self-Care measures regarding premenstrual syndrome among female nursing students. *Int J Nurs*. 2015;5(2):1–10.
- Raval CM, Panchal BN, Tiwari DS, Vala AU, Bhatt RB. Prevalence of premenstrual syndrome and premenstrual dysphoric disorder among college students of Bhavnagar, Gujarat. *Indian J Psychiatry*. 2016;58(2):164.
- Hamaideh S, Al-Ashram S, Al-Modallal H. Premenstrual syndrome and premenstrual dysphoric disorder among Jordanian women. *J Psychiatr Ment Health Nurs*. 2014;21(1):60–68.
- Indusekhar R, Usman Sa B, O'Brien S. Psychological aspects of premenstrual syndrome. *Best Pract Res Clin Obstet Gynaecol*. 2007;21(2):207–220.
- Bastani F, Hashemi S. Effects of a web based lifestyle education on general health and severity of the symptoms of Premenstrual Syndrome (PMS) among female students: a randomized controlled trial. *Procedia-Soc Behav Sci*. 2012;46:3356–3362.
- Rapkin AJ, Mikacich JA. Premenstrual dysphoric disorder and severe premenstrual syndrome in adolescents. *Pediatr Drugs*. 2013;15(3):191–202.
- Zaka M, Mahmood KT. Pre-menstrual syndrome-a review. *J Pharm Sci Res*. 2012;4(1):1684–1691.
- Maged AM, Abbassy AH, Sakr HR, et al. Effect of swimming exercise on premenstrual syndrome. *Arch Gynecol Obstet*. 2018;297(4):951–959.
- Mohebbi-Dehnavi Z, Jaafarnejad F, Kamali Z, Mohammad A-S. The effect of eight weeks aerobic exercise on psychological symptoms of premenstrual syndrome. *Nursing Practice Today*. 2017;4(4):180–189.
- Baysal B, Berkman S, Topuz S, eds. *Premenstrual syndrome and dysmenorrhea*. Gynecology. İstanbul: Nobel Medical Bookstores; 2004:47–49.
- Kirkby R, Lindner H. Exercise is linked to reductions in anxiety but not premenstrual syndrome in women with prospectively-assessed symptoms. *J Psychol*. 1998;3(2):211–222.
- Kroll-Desrosiers AR, Ronnenberg AG, Zagarins SE, Houghton SC, Takashima-Uebelhoeer BB, Bertone-Johnson ER. Recreational physical activity and premenstrual syndrome in young adult women: a cross-sectional study. *PLoS One*. 2017;12(1):e0169728.
- Tsai S-Y, Kuo F-C, Kuo H-C, Liao L-L. The prevalence of self-reported premenstrual symptoms and evaluation of regular exercise with premenstrual symptoms among female employees in Taiwan. *J Women Health*. 2018;58(3):247–259.
- Stoddard JL, Dent CW, Shames L, Bernstein L. Exercise training effects on premenstrual distress and ovarian steroid hormones. *Eur J Appl Physiol*. 2007;99(1):27–37.
- Steege JF, Blumenthal JA. The effects of aerobic exercise on premenstrual symptoms in middle-aged women: a preliminary study. *J Psychosom Res*. 1993;37(2):127–133.
- Aganoff JA, Boyle GJ. Aerobic exercise, mood states and menstrual cycle symptoms. *J Psychosom Res*. 1994;38(3):183–192.
- El-Lithy A, El-Mazny A, Sabbour A, El-Deeb A. Effect of aerobic exercise on premenstrual symptoms, haematological and hormonal parameters in young women. *J Obstet Gynaecol*. 2015;35(4):389–392.
- Ghanbari Z, Manshavi FD, Jafarabadi MJ. The effect of three months regular aerobic exercise on premenstrual syndrome. *JoF Health R*. 2008:167–171.
- Jafarnejad F, Mojahedi M, Shakeri M, Sardar MJ. Effect of aerobic exercise program on premenstrual syndrome in women of hot and cold temperaments. *JoBUOMS*. 2016;18(8):54–60.
- Samadi Z, Taghian F, Valiani M. The effects of 8 weeks of regular aerobic exercise on the symptoms of premenstrual syndrome in non-athlete girls. *Iran J Nurs Midwifery Res*. 2013;18(1):14.
- Tonekaboni MM, Peeri M, Azarbayjani MA. Effect of two intensity of aerobic exercise on clinical symptoms of premenstrual syndrome in fertile women. *Middle East Fertil Soc J*. 2012;19(3):295–301.
- Koushkie Jahromi M, Gaeini A, ZJGe Rahimi. Influence of a physical fitness course on menstrual cycle characteristics. *Gynecol Endocrinol*. 2008;24(11):659–662.
- Omidali F. Effects of pilates and Vitamin E on symptoms of premenstrual syndrome. *J Res Dev Nurs Midwifery*. 2016;13(1):1–9.
- Tsai S-Y. Effect of yoga exercise on premenstrual symptoms among female employees in Taiwan. *Int J Environ Res. Public Health Res*. 2016;13(7):721.
- Zhang H, Zhu M, Song Y, M Kong. Baduanjin exercise improved premenstrual syndrome symptoms in Macau women. *J Tradit Chin Med*. 2014;34(4):460–464.
- Abbaspour Z, Rostami M, SJJoRiHs Najjar. The effect of exercise on primary dysmenorrhea. *J Res Health Sci*. 2006;6(1):26–31.
- Yen J-Y, Chang S-J, Ko C-H, et al. The high-sweet-fat food craving among women with premenstrual dysphoric disorder: emotional response, implicit attitude and rewards sensitivity. *Psychoneuroendocrinology*. 2010;35(8):1203–1212.

Havva Yesildere Saglam:Research Assistant in Eskisehir Osmangazi University, Faculty of Health Sciences. **Practice areas:** women health, gender equality, reproductive health-sexual health, breastfeeding.

Özlem Örsal:Associate Professor Doctor in Eskisehir Osmangazi University, Faculty of Health Sciences. **Practice areas:** public health nursing, occupational health and safety, clinical nursing.