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Effect of video-based exercise on premenstrual symptoms: a randomized controlled trial

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ABSTRACT

Objectives: This study aims to investigate the impact of Pilates exercises on premenstrual syndrome (PMS) symptoms, perceived stress levels, and pain intensity.

Material and methods: Forty-six women with PMS participated in this study and were assigned to the intervention and control groups based on their willingness to participate. The intervention group undertook Pilates practices via video recording twice a week for 8 weeks, while the control group did not engage in regular exercise during the same period. PMS symptoms were assessed using the Premenstrual Syndrome Scale (PMSS), premenstrual stress levels were evaluated using the Perceived Stress Scale (PSS), and premenstrual pain levels were assessed using the McGill Melzack Pain Questionnaire (MPQ) at both the beginning and end of the study.

Results: There was a significant difference observed in the PMSS, PSS and MPQ evaluations of the intervention group following their participation in Pilates practices ($p < 0.05$). Conversely, no significant difference was observed in the PMSS, PSS and MPQ evaluations of the control group at the end of the study ($p > 0.05$). There was no statistically significant difference between the two groups in PMSS evaluation ($p > 0.05$) at the end of the study. However, a statistically significant difference was detected in PSS and MPQ evaluations ($p < 0.05$).

Conclusions: Pilates exercise can affectively decrease the perceived stress level and pain severity in PMS affected women. This study highlights the efficacy of Pilates for physiotherapists in PMS symptom reduction. Moreover, the implementation of a self-guided video-based home exercise program could provide patients with practical and time-efficient alternatives.

Keywords: premenstrual syndrome; pilates; stress; pain

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INTRODUCTION

Premenstrual disorders include a spectrum of conditions, including premenstrual syndrome, premenstrual dysphoric disorder, and the premenstrual exacerbation of an existing medical condition [1]. The premenstrual phase occurs 7–10 days before the onset of menstruation. Premenstrual syndrome (PMS) is a prevalent issue amongst women today, and it has physical and psychological effects on women [2].

Several evaluation methods are utilized to examine the physical and psychological alterations women undergo from the premenstrual phase through to menstrual bleeding. One commonly employed scale is the Premenstrual Syndrome Scale (PMSS), which encompasses various aspects and inquiries. The PMSS scores can indicate the intensity of premenstrual reactions experienced [3]. There are various pharmacological and non-pharmacological strategies available to manage premenstrual symptoms. The most important of the non-pharmacological methods are exercise interventions. Specifically, aerobic, swimming, yoga-based, and Pilates-based exercises have demonstrated efficacy in mitigating premenstrual symptoms [4]. Pilates exercises have been shown to manage posture disorders and balance problems effectively [5]. Moreover, positive effects have been observed in pain reduction, enhanced quality of life, and mitigation of premenstrual syndrome symptoms [6, 7]. Employing modalities that decrease premenstrual symptoms for women and increasing their awareness in this domain may alleviate discomforts including pain, stress, and mood disturbances encountered before menstrual bleeding. This, in turn, could establish a zone of comfort for women during the premenstrual phase.

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The objective of this investigation was to examine the impact of Pilates routines on symptoms of premenstrual syndrome, levels of perceived stress, and severity of pain.

MATERIAL AND METHODS

Study design

This study was conducted between February 2023 and October 2023, following ethical approval from the Non-Interventional Research Ethics Committee of Üsküdar University (61351342). The study was carried out as a randomized controlled parallel-group study, adhering to the principles of human experimentation outlined in the Declaration of Helsinki and receiving approval from the ethics committee. This study's clinical trial number is NCT05998044.

Sample size calculation

The power analysis of the study determined a sample size within a 95% confidence interval for an effect size of 0.05 and a 5% level of error. Consequently, the intervention and control groups were planned to have a minimum of 23 participants each. Statistical procedures were performed using G*Power 3.1.9.4 software.

Randomization

The research was conducted as a parallel-group study with randomized controlled manner. The names of the female volunteers who met the inclusion criteria for the study were listed on slips of paper and placed into a bag. The slips were then randomized by an evaluator using the lottery method to form groups.

Participants were given information about the objectives, duration, assessment methods and procedures of the study. Before completing the questionnaires and necessary assessments the informed consent forms were obtained from participants. Fifty-five participants were initially approached to participate in the study. However, five participants were excluded due to failure to meet the inclusion criteria, and four participants were unable to regularly complete the exercises. The participants were randomly allocated to two groups of equal size in accordance with a controlled procedure. The study sample comprised 46 individuals, with 23 subjects in both the intervention and control groups. None of the 46 participants dropped out, and all were included in the final analysis (Fig. 1).

Inclusion criteria of the study were determined as being a woman between the ages of 18–35, not having an obstacle to exercise (not having orthopedic, cardiopulmonary, mental diseases, etc. that would prevent exercise), not having given birth, having a score above the mild level in the PMSQ score, and having a normal menstrual cycle. Exclusion criteria were being on regular medication, being pregnant, being in a menopausal period, and having any gynecological disease (endometriosis, ovarian cyst, pelvic infection, fibroid/uterine tumors, *etc.*). Also, individuals who were regular drug users were not included in the study and were therefore excluded from the study.

Research groups

At the beginning and end of the study, all participants completed evaluation questionnaires using Google Surveys (through the link provided via email and WhatsApp applications) or paper questionnaires to establish the intervention and control groups. The participants' sociodemographic characteristics were evaluated using the sociodemographic information form. The scoring of premenstrual symptoms was determined with the Premenstrual Syndrome Scale (PMSS), stress levels were scored with the Perceived Stress Scale (PSS), and pain status was assessed and scored using the McGill Melzack Pain Scale (MPQ).

Control group: Participants in the control group were instructed to refrain from engaging in regular exercise activities for a period of eight weeks. At the conclusion of the eight-week interval, the assessment surveys were re-administered.

Intervention group: Before beginning the intervention exercises, we conveyed general information about Pilates to participants through face-to-face meetings or online communication via WhatsApp and Zoom. After completing the evaluation questionnaires, participants were sent a Google Drive link to access a video recording of the Pilates exercises. This enabled the patients to be informed about how to perform the exercises correctly. They were instructed to perform the exercises twice a week for 8 weeks. The physiotherapist provided written, practical, and verbal explanations for all exercises in the video recording and instructed the participants to perform them. Weekly contact was made via phone to confirm exercise completion.

The participants engaged in the prescribed exercise regimen two times per week for eight weeks. This was a mandatory requirement. Given that the participants were permitted to determine the days on which they exercised, they were able to avoid any potential issues associated with exercising during their menstrual periods.

In the Pilates exercise program, the warm-up phase lasted 10 minutes, the stretching phase 5 minutes, and the average duration of the exercises was 30–40 minutes. The initial four exercises were allocated for the warm-up phase while the final four exercises were designated for the stretching phase. Each exercise entailed performing a single set of 8 repetitions, except for the Hundred exercise which had 10 sets of 10 repetitions. The number of repetitions was gradually raised every two weeks to 10, 12, and 14 repetitions, correspondingly. Participants were instructed to activate the video recording every time they carried out

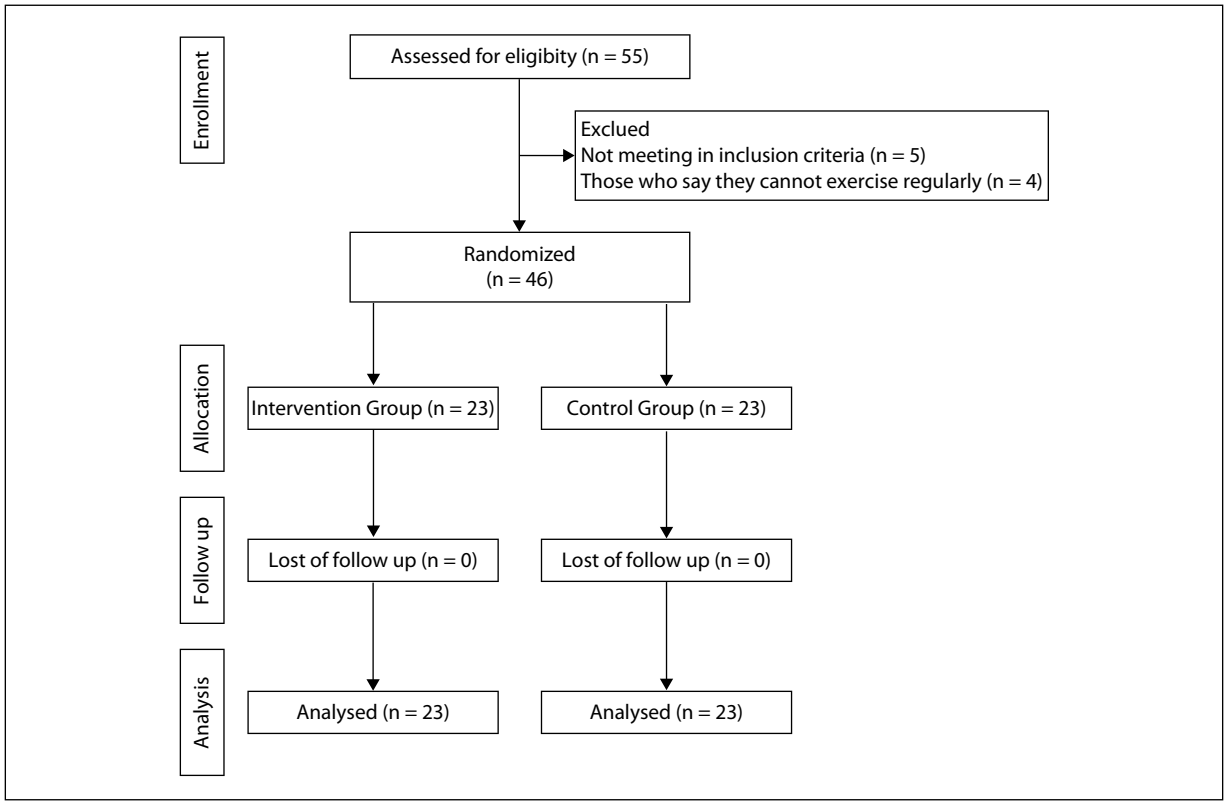

Figure 1. CONSORT diagram of the study

the exercises and then perform the exercises according to the video demonstrations. After eight weeks, participants completed reevaluation questionnaires. The exercise program consisted of Arm Circles, Toe Touch, Bridge, Shoulder Bridge, Chest, Lift Hundred, Roll Up, Leg Circles Chris Cross, Side Kick, Side Leg Circles, one leg kick, double leg kick, Swan, Single leg Stretch, Double leg Stretch, Saw and Spine Stretch (Fig. 2 A–R).

Outcome measures

Sociodemographic Information Form

To identify the personal and menstrual period traits of participants, the sociodemographic information form included questions on age, height, weight, age at menarche (in years), menstruation length (in days), menstrual cycle duration (in weeks), employment status, smoking habits, marital status, and level of education.

Premenstrual Syndrome Scale (PMSS)

The PMSQ is a 44-item, five-point Likert scale (never, very rarely, sometimes, often, always). The scoring is done by taking into account the condition "within one week before menstruation". In the scoring of the scale, "Never" option is evaluated as 1 point, "Very rarely" option as 2 points, "Sometimes" option as 3 points, "Frequently" option as 4 points and "Continuously" option as 5 points [8].

Perceived Stress Scale (PSS)

The Perceived Stress Scale, developed by Cohen et al. in 1983, has been extensively tested for validity and reliability in many studies. Comprised of 14 five-point Likert-type items, the scale offers response options ranging from "never (0)" and "almost never (1)" to "sometimes (2)," "often (3)," and "very often (4)." Items 4–7, 9, 10 and 13 are reverse-scored on this 14-item form [9]. The scale can yield scores from 0 to 56. A high total score on the Perceived Stress Level Scale indicates elevated levels of stress. Scores between 0 and 35 indicate a positive stress level, with participants demonstrating effective stress coping strategies or functional coping mechanisms. Participants who scored between 36 and 56 on the stress coping scale were found to use ineffective methods to manage stress.

McGill Melzack Pain Questionnaire (MPQ)

The MPQ is composed of four sections. The initial section comprises two depictions of the body, which depict the front and rear aspects to identify the regions of the body that have been affected by the patient's pain. Following that, the patient is requested to indicate the site of the pain on the body drawing, and if the pain is deep or on the surface of the body, mark it with the letter 'D' or 'S', correspondingly. In the subsequent part, the patient is queried about the pain's similarity to other sensations. There are 20 sets

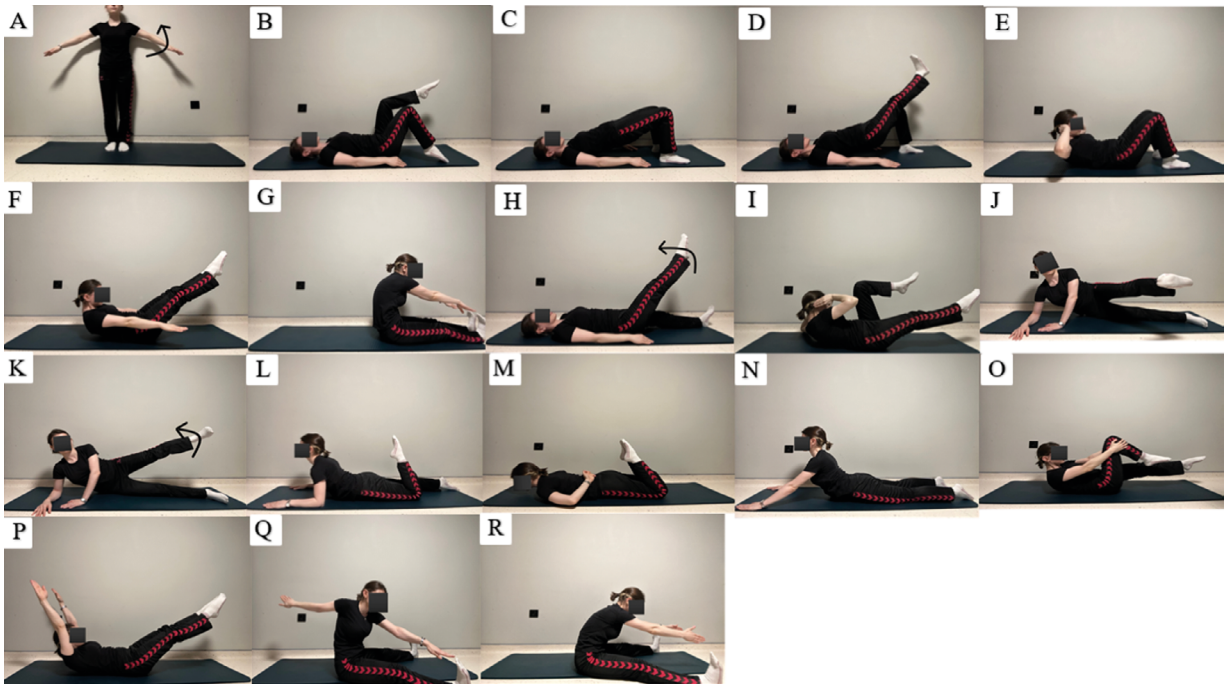

Figure 2. The Pilates exercise program

of 2 to 6 descriptive words which delineate the various aspects of pain objectively, including the sensory, perceptual, and evaluative dimensions. The initial 10 sets relate to the sensory dimension, followed by 5 sets relating to the perceptual dimension. The 16th set relates to evaluation and the concluding 4 sets relate to the multidimensional aspects of pain. The patient selects the suitable words from the respective category. Part three inquiries about the connection between pain and time. The fourth section consists of questions intended to gauge the intensity of pain, and a rating scale utilizing descriptive words is used to evaluate this [10].

Analyzing the data

Statistical analysis was performed using SPSS 28.0.1.1.1. The Shapiro-Wilk and Kolmogorov-Smirnov tests were used to assess the conformity of the variables to the normal distribution. The continuous variables were reported as mean ± standard deviation if they conformed to normal distribution, while median (minimum–maximum) values were reported for those that did not correspond to normal distribution. Categorical variables were presented as n (%). Independent group comparisons were conducted using the Mann-Whitney U test following a normality test, whilst comparisons between dependent groups were undertaken with the Wilcoxon Signed Ranks test. Results were interpreted as $p < 0.05$ indicating a statistically significant difference and $p > 0.05$ indicating no significant difference.

RESULTS

Demographic characteristics of the participants

Table 1 provides the sociodemographic and menstrual characteristics of the participants, including their age, height, weight, age at menarche, duration of menstruation, and menstrual cycle length. Upon comparison of the intervention and control groups, there was no statistically significant difference between the two groups in terms of age, age at menarche, duration of menstruation, and menstrual cycle length ($p > 0.05$), indicating homogenous distribution between the groups.

Between group and within group pre and post intervention measurements

Table 2 displays the pre- and post-questionnaire data of the MPQ for the intervention group. Although a statistically significant difference was found between pre- and post-exercise evaluations, no such difference was observed in the control group ($p > 0.05$). Additionally, statistically significant difference in PMSS scores was observed between the pre- and post-exercise assessments of the intervention group ($p < 0.05$). Conversely, no statistically significant difference in PMSS scores was observed between the pre- and post-exercise assessments of the control group ($p > 0.05$). The intervention group exhibited a significant increase in PSS scores, whereas no significant difference was observed in the control group ($p > 0.05$) during the pre- and post--exercise evaluations.

Table 1. Sociodemographic and menstrual characteristics of the participants

Variables	Intervention mean ± SD	Control mean ± SD	p value
Age [years]	25.69 ± 1.94	25.69 ± 1.84	0.982
Age at menarche [years]	13.26 ± 0.23	12.78 ± 0.39	0.073
Duration of menstruation [day]	6.56 ± 0.33	6.47 ± 0.25	0.973
Menstrual cycle duration [week]	4.04 ± 0.14	4.26 ± 0.26	0.923

*p < 0.05; SD — standard deviation

Table 2. Pre- and post-exercise measurements of the PSS, PMSS and PSS measurements

Parameters		Pretreatment mean ±SD	Posttreatment mean ± SD	p value
MPQ	Intervention	72.34 ± 8.27	67.34 ± 10.25	0.031*
	Control	72.26 ± 10.1	69.82 ±12.15	0.348
PMSS	Intervention	139 ± 29.89	118.13 ± 30.34	0.002*
	Control	122.91 ± 37.2	128.39 ± 38.91	0.285
PSS	Intervention	27.3 ± 8.88	23.17 ± 6.54	0.008*
	Control	27.82 ± 5.15	26.78 ± 6.31	0.420

*p < 0.05; MPQ — McGill Pain Questionnaire; PSS — Perceived Stress Scale; PMSS — Premenstrual Syndrome Scale

Table 3 outlines the PMSS, PSS, and MPQ findings for both the intervention and control groups. The PMSS total score showed no significant difference post-exercise (p > > 0.05). However, PSS and MPQ total scores were found to differ significantly between groups before and after exercising (p < 0.05).

DISCUSSION

The majority of women experience symptoms of PMS. These symptoms can affect people's quality of life, causing stress, pain and mood disorders. Exercise has been proven to effectively reduce the severity of such symptoms and improve quality of life [11–13]. There is limited number of research in the area of exercise therapy for PMS. Our study is the first randomized controlled study to compare the functional and patient-reported outcomes of PMS affected women who underwent the There is a paucity of research in the field of exercise therapy for PMS. Our study represents the first randomized controlled study to examine the functional and patient-reported consequences of PMS in women who performed the Pilates exercises. The main findings of this study were: (I) There was a significant decrease in symptom severity as determined by the PSS subsequent to the intervention in comparison to the initial evaluation; (II) Upon comparison of the two groups, it was discovered that the intervention group exhibited significantly lower PSS scores than the control group; (III) Despite a significant reduction in PMSS scores in the intervention group, the post treatment results showed no significant difference between the two cohorts in statistical terms; (IV) Participants in the intervention group were shown to have lower MPQ scores than those in the control group.

PMS symptoms may vary depending on the age at which menarche occurs and the length of menstruation. Thus, the impact of these variables on PMS symptoms could differ among individuals, making a personalized evaluation necessary. This outcome indicates that PMS is a multifaceted syndrome with interactions among numerous variables [13–17]. A study investigated the impact of yoga exercises on PMS symptoms in employed women and found that the symptoms were lower compared to those who were unemployed [11]. In our research, we found no significant difference between the average PMSS scores of employed and unemployed women. Furthermore, the nature of one's occupation could influence PMS symptoms, which may vary across different occupational groups. Hence, it is necessary to investigate the impact of work experiences on the PMSS score of individuals. A study involving 40 university students experiencing PMS symptoms observed a decrease in symptoms when Pilates exercises were combined with vitamin E. Another study investigating the effects of Pilates exercises on university students with PMS symptoms reported a reduction in symptoms after three months of exercising [13, 18]. Upon analysis of the PSS evaluation of the intervention group in our study, a notable reduction in symptom severity was observed compared to the initial evaluation. Compared to controls, the intervention group showed more decrease in all 9 PSS sub parameters, including depressed affect, anxiety,

Table 3. PMSS, PSS, and MPQ results of the intervention and control groups post treatment

Parameters	Intervention group mean ± SD	Control group mean ± SD	p value
MPQ	67.34 ± 10.25	69.82 ± 12.15	0.030*
PMSS	118.13 ± 30.34	128.39 ± 38.91	0.080
PSS	23.17 ± 6.54	26.78 ± 6.31	0.007*

*p < 0.05; MPQ — McGill Pain Questionnaire; PSS — Perceived Stress Scale; PMSS — Premenstrual Syndrome Scale

fatigue, irritability, depressive thoughts, pain, appetite changes, sleep changes and bloating. Although there was a reduction in the PMSS score in the intervention group, the results did not show a statistically significant difference between the two groups. Therefore, it cannot be clearly concluded that the intervention group was more successful in reducing symptoms than the control group. This may be due to factors such as the small sample size, the duration of the exercises and the length of the intervention period.

Pilates may reduce stress in PMS, with studies suggesting that it is more effective than aerobic exercise at reducing both stress and psychological symptoms [19, 20]. In our study, there was a significant decrease in PSS scores in the intervention group at the final assessment in comparison to the first assessment. In other words, people's perceived stress levels decreased as a result of doing Pilates. Comparing both groups, it was found that the intervention group had statistically significant lower PSS scores than the control group. In this context, the reduction in stress levels can also be associated with the Pilates exercises and therefore the Pilates principles.

Regular exercise helps to strengthen muscles, increase flexibility, improve circulation and increase the release of endorphins. Endorphins act as the body's natural painkillers and happiness hormones, so an increase in endorphin levels through exercise helps to reduce pain. Our investigation revealed a substantial reduction in the intervention group's MPQ scores at the final assessment in contrast to the first assessment, with statistical significance recorded. Conversely, no significant score reduction was observed in the control group at the last assessment in comparison to the first. It was also shown that people in the intervention group experienced a greater reduction in pain than those in the control group. It is encouraging that the intervention group showed a reduction in PMS symptoms. This can allow individuals to exercise at their leisure, unrestricted by time or space. These results showed that Pilates exercise programs recorded via video for women with PMS symptoms have no adverse effects, making for a safe and easily accessible treatment approach.

This study provides an opportunity to further understand the beneficial effects of exercise on PMS management for gynecologists, physiotherapists, and other healthcare professionals involved in PMS management. Increasing awareness of the potential health benefits of exercise for people with PMS may increase referrals to exercise-based physiotherapy programs. The present research provides valuable objective findings regarding the functional and self-reported results of various exercise programs for women with PMS. These observations could effectively assist physiotherapists in determining the most suitable exercise regimen to enhance selective patient outcomes.

The current randomized controlled trial is a novel contribution to the field of exercise therapy for PMS. This study presents the first evaluation of Pilates exercise programs in women with PMS, analyzing both functional and patient-reported outcomes. Recognizing the significance of limitations in this study, the utilization of general PSS and MPQ questionnaires instead of a condition-specific questionnaire could have introduced external factors like psychosocial or life stressors that may have affected the study's outcomes. Expanding the intervention technique and evaluating different exercise modalities or extending the intervention duration of the Pilates exercise studies are prospective focuses for future research.

CONCLUSIONS

Pilates practice resulted in a significant reduction in PMSS, PSS and MPQ scores. Notably, while no meaningful variance between the intervention and control groups' PMSS score was perceived during the post-intervention data comparison, there was a discernible difference in PSS and MPQ scores. We demonstrated that correct muscle usage and improved muscle awareness through Pilates may effectively alleviate the symptoms of PMS. The results suggest that individuals suffering from PMS symptoms may gain advantages from non-pharmacological interventions. Therefore, in order to guide patients towards these interventions, health professionals are advised to educate patients about some exercise modalities such as home or video-based exercises.

Article information and declarations

Data availability statement

The data is available upon request.

Ethics statement

The ethical approval was taken from the Non-Interventional Research Ethics Committee of Üsküdar University (61351342). This study's clinical trial number is NCT05998044.

Author contributions

Şeyma Aykut — conceptualization, methodology, data curation, writing — original draft preparation, visualization, investigation; Ömer Şevgin — conceptualization, methodology, data curation, writing — rriginal draft preparation, supervision, validation, writing — reviewing and editing.

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None.

Conflict of interest

The authors declare no conflict of interest.

Supplementary material

None.

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