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Research Article

The Effects of Pelvic Floor Exercises Applied in Addition to Pilates on Premenstrual Symptoms, Pain, Sleep, and Quality of Life in Individuals with Premenstrual Syndrome (PMS)

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Abstract

Aim: This study aimed to examine the effects of adding pelvic floor muscle exercises to a Pilates program on premenstrual symptoms, pain intensity, sleep quality and quality of life in women with premenstrual syndrome (PMS).

Material and Methods: A total of 30 women with Premenstrual Syndrome Scale (PMSS) scores ≥111 were randomly assigned to either a Pilates group (PG, n=15) or a Pilates plus pelvic floor muscle training group (PFMT, n=15). PMS severity, pain, sleep quality, and quality of life were assessed using the PMSS, Visual Analog Scale (VAS), Pittsburgh Sleep Quality Index (PSQI), and Short Form-12 (SF-12). Both groups completed supervised 50-minute exercise sessions twice weekly for eight weeks.

Results: Both interventions resulted in statistically significant within-group improvements in premenstrual symptom severity, pain intensity, sleep quality, and quality of life ($p < 0.01$). However, no statistically significant differences were observed between the Pilates and Pilates + PFMT groups for any of the assessed outcomes ($p > 0.05$). The observed changes reflect improvements over time within each group rather than differential effects between interventions.

Conclusion: Pilates-based exercise programs were associated with meaningful improvements in pain, sleep quality, and quality of life in women with PMS. Within the parameters of the present study, the addition of pelvic floor muscle training did not result in statistically detectable between-group differences. Pelvic floor–focused exercises may represent a complementary component of exercise programs aimed at supporting physical and psychological well-being in women with PMS.

Keywords: Premenstrual Syndrome, Pilates-Based Exercises, Pelvic Floor, Quality of Life, Pain

INTRODUCTION

Premenstrual syndrome (PMS) is a condition characterized by psychiatric and physical or behavioral symptoms that emerge during the late luteal phase of the menstrual cycle and subside shortly after menstruation begins, often interfering with daily functioning [1]. It typically presents with a combination of physical symptoms such as breast tenderness or swelling, joint or muscle pain, bloating, and weight gain and at least one affective manifestation, including irritability, depressed mood, internal tension, difficulty concentrating, or fatigue [2]. PMS affects approximately 25% of women with regular menstrual cycles, while epidemiological data indicate that nearly four out of ten women experience premenstrual symptoms, and 5–8% are severely affected [3]. Although the precise pathophysiology of PMS has not been fully elucidated, it is widely considered a multifactorial condition involving the interaction of hormonal fluctuations, central nervous system mechanisms, and psychosocial factors. In particular, cyclical changes in sex steroids—especially progesterone—are thought to influence central pathways related to pain perception, mood regulation, and sleep. Additionally, individual susceptibility, including genetic and lifestyle-related factors, may modulate symptom severity and clinical presentation [4].

PMSis a common cyclic condition that imposes significant physical and psychological burdens on affected individuals, and

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the lack of a definitive curative treatment highlights the need to evaluate the effectiveness of different therapeutic approaches. Pharmacological interventions particularly selective serotonin reuptake inhibitors (SSRIs) and hormonal agents such as oral contraceptives are widely used in PMS management; however, their long-term use is often limited by adverse effects, with discontinuation rates reported to be as high as 69% for SSRIs [5]. Consequently, non-pharmacological and multimodal strategies, including exercise-based interventions and patient-centered self-management approaches, have gained increasing attention. Despite these efforts, an optimal and universally effective treatment for PMS has yet to be established [6].

Exercise has been widely recognized as an important non-pharmacological approach for alleviating PMS symptoms and is frequently preferred as a first-line intervention [7]. Evidence from randomized controlled trials and meta-analyses indicates that regular physical activity is associated with reductions in both physical and psychological PMS symptoms, potentially through mechanisms related to improved pain modulation, emotional regulation, and sleep quality [8, 9]. Exercise has also been linked to enhanced mood, increased self-esteem, and reduced levels of anxiety and depressive symptoms during the premenstrual phase. However, findings across studies remain inconsistent, as some investigations report symptom improvement with physical activity, whereas others suggest no benefit or even increased premenstrual discomfort among physically active women [10, 11].

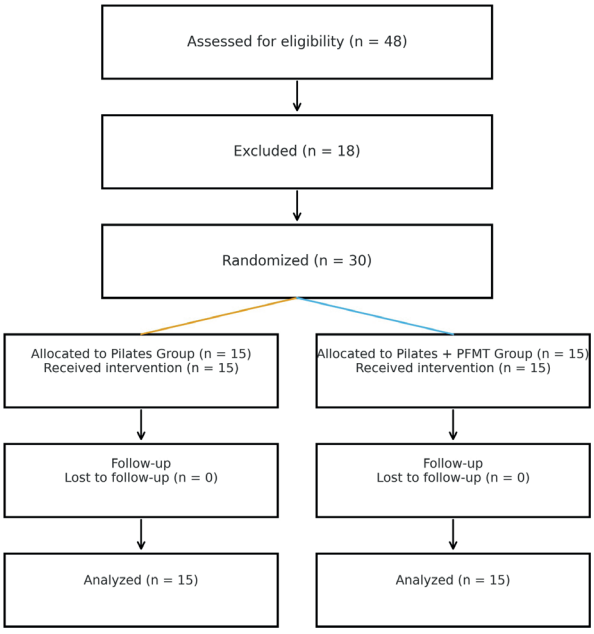
Pilates is a comprehensive exercise system designed to integrate body and mind, contributing to the enhancement of overall physical and psychological well-being. It improves core and pelvic stability, posture, balance, flexibility, and muscular strength, while also supporting relaxation, quality sleep, and stress regulation[12]. By Through controlled breathing, focused concentration, and mindful movement, Pilates may help alleviate PMS symptoms by promoting physical balance and emotional regulation. Furthermore, its potential effects on serotonin activation and pain modulation suggest a role in reducing depressive mood and psychological discomfort during the premenstrual phase [13].

In the context of PMS, the coordinated interaction among the pelvic floor muscles (PFMs), diaphragm, and abdominal wall represents an important component of lumbopelvic neuromuscular function [14]. Cyclical hormonal fluctuations, particularly variations in estrogen and progesterone levels, may influence muscle tone, postural control, autonomic balance, and breathing patterns during the premenstrual phase. Pelvic floor muscle training (PFMT), especially when integrated into Pilates-based exercise, may therefore exert effects that extend beyond local pelvic symptoms by enhancing neuromuscular coordination and afferent sensory input to the central nervous system. Through its potential influence on central pain modulation, autonomic regulation, and stress-related pathways, this integrative approach may contribute to improvements in pain perception, sleep quality, and emotional regulation commonly affected in PMS [15]. By supporting both mechanical stability and central regulatory mechanisms, PFMT within a Pilates framework provides a physiological rationale for addressing the multidimensional symptom profile of PMS.

Therefore, the present study aims to investigate the effects of incorporating pelvic floor exercises into a Pilates program on premenstrual symptoms, pain intensity, sleep quality, overall quality of life, and the propensity for aggression among individuals with PMS. This approach seeks to provide a comprehensive understanding of how combined mind–body and pelvic-focused interventions may influence both the physical and psychosocial dimensions of PMS.

MATERIAL AND METHODS

The study protocol was approved by the Non-Interventional Research Ethics Committee of Üsküdar University (Approval No: 61351342/October 2023-24), and all procedures were conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to data collection. The flow of participants through each stage of the study, including screening, allocation, follow-up, and analysis, is illustrated in the CONSORT flow diagram presented in Figure 1.



The study was conducted between December 1, 2023, and April 1, 2024, in a Pilates studio. Women who applied to the studio were informed about the study and completed the Premenstrual Syndrome Scale (PMSS). Of the 48 women assessed for eligibility, 30 participants with PMSS scores ≥111 who met the inclusion criteria were enrolled and allocated to the intervention groups. Inclusion criteria comprised willingness to participate; a PMSS score of ≥111; experiencing premenstrual symptoms for at least three months; reporting a pain

intensity of ≥4 on the Visual Analog Scale (VAS) during any menstrual period within the previous three months; and having a regular menstrual cycle lasting 24–35 days for at least 12 months. Exclusion criteria included being under 18 years of age; changes in menstrual characteristics following PMS diagnosis; pregnancy; receiving hormone therapy; a history of hysterectomy; surgery within the past six months; presence of chronic systemic diseases; musculoskeletal, urinary, genital, or gastrointestinal disorders; and any medical condition that could limit participation in Pilates-based exercise.

Participants were allocated into two equal intervention groups: a Pilates group (PG, n = 15) and a PFMT (n = 15). Due to the nature of the exercise-based interventions, blinding of participants was not feasible. However, outcome assessments were performed by an assessor who was blinded to group allocation and was not involved in the delivery of the interventions. Accordingly, the study was conducted as a single-blind trial, with blinding applied at the level of outcome assessment.

Premenstrual syndrome severity, pain intensity, sleep quality, and quality of life were evaluated using the Premenstrual Syndrome Scale (PMSS), Visual Analog Scale (VAS), Pittsburgh Sleep Quality Index (PSQI), and Short Form-12 (SF-12), respectively. All outcome measures were assessed at baseline, one week prior to the expected onset of menstruation.

Both groups participated in supervised exercise sessions twice weekly for eight weeks, with each session lasting 50 minutes. All interventions were delivered as planned, and no protocol deviations were reported. The Pilates program was delivered by certified Pilates instructors and emphasized controlled breathing, core stabilization, postural alignment, and whole-body movements, with exercises performed progressively and coordinated with breathing. In the PFMT group, pelvic floor muscle training was integrated into the Pilates sessions under the supervision of a physiotherapist specialized in pelvic floor rehabilitation. Participants performed voluntary maximal pelvic floor muscle contractions synchronized with exhalation, with each contraction held for approximately 5 seconds followed by a 5-second relaxation period. Exercises were performed in sets of five repetitions, with multiple sets incorporated throughout the session according to participant tolerance. PFMT exercises were primarily conducted in supine and sitting positions and were guided verbally and tactically by the physiotherapist to ensure correct muscle activation and appropriate coordination with breathing. The physiotherapist was responsible for instructing correct pelvic floor muscle activation, monitoring exercise performance, and correcting compensatory movements when necessary. Verbal and tactile feedback was provided throughout the sessions to facilitate accurate muscle engagement. Pelvic floor muscle training was not implemented as a separate training block but was embedded within selected Pilates exercises by synchronizing pelvic floor contractions with core stabilization and breathing components. Pelvic floor muscle strength was not quantitatively assessed before or after the intervention.

The Premenstrual Syndrome Scale (PMSS) is a self-report instrument developed by Gençdoğan (2006) [16] to evaluate the severity of premenstrual symptoms. The scale consists of 44 items rated on a five-point Likert scale (1= never, 2= rarely, 3= sometimes, 4= often, 5= always) and encompasses nine subdimensions: depressive affect, anxiety, fatigue, irritability, depressive thoughts, pain, appetite changes, sleep disturbances, and swelling. The total score, derived from the sum of all items, ranges from 44 to 220, with higher scores indicating more severe premenstrual symptoms. A cutoff score of 111 or higher, corresponding to 50% of the total possible score, is used to indicate the presence of PMS.

The SF-12 is a concise health-related quality of life instrument derived from the SF-36, comprising 12 items covering eight domains: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health. Scores for each domain range from 0 to 100 (higher values indicate better health), and the instrument yields two summary indices: the Physical Component Summary (PCS) and the Mental Component Summary (MCS). Recent validation work in diverse populations supports its reliability and validity [17].

The Pittsburgh Sleep Quality Index (PSQI) is a self-administered questionnaire developed to assess sleep quality, duration, and disturbances over the previous month. It consists of 19 items evaluating seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is rated on a 0–3 scale, and the sum of these scores yields a global score ranging from 0 to 21, with higher values indicating poorer sleep quality. A total score of greater than 5 distinguishes poor sleepers from good sleepers, and recent studies have confirmed the reliability and validity of the PSQI in diverse populations [18].

The Visual Analog Scale (VAS) is a straightforward and reliable self-report tool used to quantify pain intensity. It typically consists of a 100-mm horizontal line anchored with descriptors such as “no pain” at one end and “worst imaginable pain” at the other. Respondents indicate their current pain level by marking a point on the line; the millimetre distance from the “no pain” end to the mark corresponds to the pain score. Higher distances represent greater pain intensity. Recent research has further explored the VAS’s concurrent validity and its applicability across different populations and settings [19].

Statistical Analysis

An a priori power analysis was performed using G*Power version 3.1, based on the randomized controlled trial [12], which examined the effects of Pilates on premenstrual syndrome using the Premenstrual Syndrome Scale (PMSS). Assuming a moderate effect size (f = 0.25), a significance level of 0.05, and a power of 0.80, the required sample size was estimated

at 28 participants (14 per group). To compensate for potential dropouts, the total sample was set at 30 participants, considered sufficient to detect meaningful changes in PMSS scores. Data were analyzed using SPSS for Windows (version 22.0; IBM Corp., Armonk, NY, USA). The normality of data distribution was examined to determine the appropriate statistical approach. Given the small sample size and non-normal distribution, nonparametric tests were employed [20]. The Mann–Whitney U test was used for comparisons between independent groups, and the Wilcoxon signed-rank test was applied for within-group comparisons. Relationships between categorical variables were analyzed using the Chi-square test. Effect sizes (r) were calculated to determine the magnitude of significant differences, interpreted according to Cohen's criteria as small ($0.10 \leq r < 0.30$), medium ($0.30 \leq r < 0.50$), or large ($r \geq 0.50$). Statistical significance was set at $p < 0.05$.

RESULTS

No significant difference was seen when comparing the demographic information of the study and control groups ($p>0.05$) (Table 1).

As shown in Table 2, there were no statistically significant differences between the Pilates + PFMT and Pilates groups in pre-test ($p > 0.05$) or post-test PMS total scores ($p > 0.05$). Within-group analyses revealed statistically significant pre- to post-test improvements in both groups (Pilates + PFMT: $p < 0.01$; Pilates: $p < 0.01$). Regarding the PMS subscales, no statistically significant between-group differences were observed at either time point ($p > 0.05$). Significant within-group improvements were detected in the Pilates + PFMT group across all subdimensions ($p < 0.01$). In the Pilates group, statistically significant improvements were observed in depressive effects, fatigue, irritability, depressive thoughts, and pain ($p < 0.01$).

Effect sizes were calculated only for within-group comparisons to describe the magnitude of changes over time and were interpreted according to Cohen's criteria (small = 0.10, medium = 0.30, large ≥ 0.50).

As shown in Table 3, no statistically significant differences were found between the Pilates + PFMT and Pilates groups in pre- or post-test SF-12 physical and mental component scores ($p > 0.05$). Within-group analyses demonstrated statistically significant improvements in both groups for the physical component (Pilates + PFMT: $p < 0.01$; Pilates: $p < 0.01$) and the mental component (Pilates + PFMT: $p < 0.05$; Pilates: $p < 0.05$).

Effect sizes were reported to indicate the magnitude of within-group changes over time and were not used to infer between-group differences.

As presented in Table 4, no statistically significant differences were observed between the Pilates + PFMT and Pilates groups in pre- or post-test PSQI scores ($p > 0.05$). Within-group analyses revealed statistically significant improvements from pre- to post-test in both groups (Pilates + PFMT: $p < 0.01$; Pilates: $p < 0.05$).

Effect sizes reflect the magnitude of within-group changes and do not indicate statistically significant differences between groups.

As shown in Table 5, no statistically significant differences were found between the Pilates + PFMT and Pilates groups in pre- or post-test VAS scores ($p > 0.05$). Within-group analyses revealed statistically significant reductions in pain intensity from pre- to post-test in both groups (Pilates + PFMT: $p < 0.01$; Pilates: $p < 0.01$).

Effect sizes were calculated to describe within-group changes in pain intensity according to Cohen's criteria.

Table 1. Baseline characteristics

	PFMT Median (Min-Maks)		PG Median (Min-Maks)		Groups
Age	34.0 (22.0-43.0)		33.0 (27.0-44.0)		p^a >0.05
Given Birth	0.0 (0.0-2.0)		1.0 (0.0-3.0)		p^a >0.05
Pilates experience (months)	6.0 (3.0-15.0)		5.0 (2.0-8.0)		p^a >0.05
Menstrual cycle regularity	Regular	14	Regular	12	pc >0.05
	Irregular	1	Irregular	3	

Bold values indicate that it is statistically significant (p<0.05); PFMT: Pilates plus pelvic floor muscle training group; PG: Pilates group; Min: Minimum; Maks: Maksimum; Med: Median; pa: Mann- Whitney U test; pc: Chi-square test

Table 2. Comparison of PMSS total scores within and between groups

		PFMT Median (Min-Maks)	PG Median (Min-Maks)	Groups p[a]
PMSS Total Score	Pre-test	130.0 (111.0-202.0)	120.0 (111.0-168.0)	p=0.17
	Post-test	108.0 (15.0-160.0)	107.0 (89.0-152.0)	p=0.48
p[b]		**p < 0.001**	**p < 0.001**	
Depressive sensation Score	Pre-test	19.0 (9.0-33.0)	18.0 (12.0-30.0)	p=0.74
	Post-test	18.0 (7.0-28.0)	16.0 (10.0-28.0)	p=0.71
p[b]		**p < 0.001**	**p < 0.001**	
Anxiety Score	Pre-test	15.0 (7.0-29.0)	12.0 (8.0-28.0)	p=0.19
	Post-test	12.0 (7.0-24.0)	12.0 (8.0-28.0)	p=0.55
p[b]		**p < 0.001**	**p=0.42**	
Fatigue Score	Pre-test	18.0 (15.0-28.0)	20.0 (12.0-28.0)	p=0.57
	Post-test	15.0 (10.0-21.0)	15.0 (10.0-20.0)	p=0.95
p[b]		**p < 0.001**	**p < 0.001**	
Nervousness Score	Pre-test	20.0 (10.0-25.0)	16.0 (6.0-20.0)	p=0.60
	Post-test	15.0 (9.0-21.0)	15.0 (6.0-18.0)	p=0.46
p[b]		**p < 0.001**	**p=0.03**	
Depressive thoughts Score	Pre-test	16.0 (10.0-30.0)	10.0 (8.0-18.0)	p=0.95
	Post-test	12.0 (7.0-32.0)	10.0 (6.0-16.0)	p=0.15
p[b]		**p < 0.001**	**p=0.03**	
Pain Score	Pre-test	12.0 (8.0-15.0)	12.0 (8.0-15.0)	p=0.86
	Post-test	8.0 (6.0-12.0)	10.0 (5.0-12.0)	p=0.06
p[b]		**p < 0.001**	**p < 0.001**	
Appetite Changes Score	Pre-test	14.0 (10.0-15.0)	13.0 (10.0-15.0)	p=0.60
	Post-test	10.0 (8.0-15.0)	12.0 (10.0-15.0)	p=0.18
p[b]		**p < 0.001**	**p=0.04**	
Sleep Pattern Changes Score	Pre-test	8.0 (3.0-15.0)	7.0 (3.0-10.0)	p=0.49
	Post-test	6.0 (3.0-10.0)	5.0 (3.0-10.0)	p=0.97
p[b]		**p < 0.001**	**p=0.06**	
Bloating (or swelling) Score	Pre-test	14.0 (6.0-15.0)	15.0 (5.0-15.0)	p=0.35
	Post-test	10.0 (4.0-15.0)	15.0 (5.0-15.0)	p=0.30
p[b]		**p=0.02**	**p=0.03**	

Bold values indicate that it is statistically significant (p<0.05); pa:Mann-Whitney U test; pb; Wilcoxon test; PFMT: Pilates plus pelvic floor muscle training group; PG: Pilates group; Min: Minimum; Maks: Maksimum; Med: Median

Table 3. Comparison of SF-12 Physical and Mental Health Subscale Scores

		PFMT Median (Min-Maks)	**PG Median (Min-Maks)**	**Groups p[a]**
SF12-PS	Pre-test	52.0 (43.0-56.0)	53.0 (46.0-55.0)	p=0.83
	Post-test	55.0 (52.0-56.0)	55.0 (50.0-56.0)	p=0.34
p[b]		**p < 0.001**	**p < 0.001**	
SF12-MS	Pre-test	60.0 (53.0-61.0)	60.0 (55.0-60.0)	p=0.76
	Post-test	60.0 (54.0-61.0)	60.0 (58.0-61.0)	p=0.83
p[b]		**p=0.03**	**p < 0.001**	

Bold values indicate that it is statistically significant (p<0.05); pa:Mann-Whitney U test; pb; Wilcoxon test; PFMT: Pilates plus pelvic floor muscle training group; PG: Pilates group; SF12-PS: Short Form-12 Physical Score; SF12-MS: Short Form-12 Mental Score; Min: Minimum; Maks: Maksimum; Med: Median

Table 4. Comparison of PSQI Scores Between Groups at Pre- and Post-Test

		PFMT Median (Min-Maks)	**PG Median (Min-Maks)**	**Groups p[a]**
PSQI Scores	Pre-test	1.0 (0.0-5.0)	2.0 (0.0-5.0)	p=0.31
	Post-test	1.0 (0.0-3.0)	2.0 (0.0-4.0)	p=0.09
p[b]		**p < 0.001**	**p=0.02**	

Bold values indicate that it is statistically significant (p<0.05); pa:Mann-Whitney U test; pb; Wilcoxon test; PFMT: Pilates plus pelvic floor muscle training group; PG: Pilates group; PSQI: The Pittsburgh Sleep Quality Index; Min: Minimum; Maks: Maksimum; Med: Median

Table 5. Comparison of Pain Scores (VAS) Between Groups at Pre- and Post-Test

		PFMT Median (Min-Maks)	PG Median (Min-Maks)	Groups p[a]
VAS Score	Pre-test	6.0 (5.0-8.0)	6.0 (3.0-8.0)	p=0.58
	Post-test	3.0 (2.0-5.0)	3.0 (2.0-7.0)	p=0.58
p[b]		**p < 0.001**	**p < 0.001**	

Bold values indicate that it is statistically significant (p<0.05); pa:Mann-Whitney U test; pb; Wilcoxon test; PFMT: Pilates plus pelvic floor muscle training group; PG: Pilates group; VAS: The Visual Analog Scale; Min: Minimum; Maks: Maksimum; Med: Median

DISCUSSION

This study evaluated the effects of adding pelvic floor muscle training (PFMT) to a Pilates program on premenstrual symptoms, pain intensity, sleep quality, and quality of life in women with PMS. Both exercise programs resulted in statistically significant within-group improvements in several key outcomes, including reductions in pain intensity, improvements in sleep quality, and enhancements in quality of life. However, no statistically significant between-group differences were observed between the Pilates and Pilates + PFMT groups for any of the primary or secondary outcomes.

These findings suggest that, within the duration and parameters of the present intervention, a Pilates-based exercise program alone may be sufficient to elicit clinically meaningful benefits in women with PMS. At the same time, the absence of between-group differences should be interpreted with caution and does not necessarily indicate a lack of potential benefit of PFMT. Rather, this finding highlights the need to consider intervention-related factors—such as exercise dosage, intervention duration, and outcome sensitivity—that may have influenced the ability to detect additional effects of PFMT beyond those achieved with Pilates alone.

Pelvic floor muscle training (PFMT) has been proposed to prevent or manage stress urinary incontinence and pelvic organ prolapse by improving the ability to consciously contract the pelvic floor muscles during increases in intra-abdominal pressure and by strengthening these muscles to provide structural support [21]. Beyond its urogenital benefits, PFMT may also influence hormonal balance and pelvic circulation, which are often disrupted during the premenstrual phase. In this study, combining PFMT with Pilates was hypothesized to enhance pelvic stability and awareness, thereby alleviating PMS-related symptoms such as pelvic discomfort, fatigue, and mood changes. Similar findings have been reported by Deodato [22], who observed that pelvic floor exercises effectively reduced menstrual pain and improved quality of life in women with primary dysmenorrhea.

At the end of the study, both groups were found to benefit from the interventions. Although several studies have reported that exercise can effectively reduce symptoms in individuals with PMS, research specifically examining the effects of Pilates on PMS remains limited. Sheerin Banu [23] demonstrated that Pilates-based exercise programs significantly reduced premenstrual and menstrual symptoms, supporting the findings of the present study. Similarly, pelvic floor muscle training (PFMT) has been shown to improve pelvic function and quality of life in women [24]. However, to the best of our knowledge, no previous study has directly investigated the effect of PFMT on PMS-related symptoms. Therefore, the present study contributes new insight by exploring the potential role of PFMT combined with Pilates in managing PMS symptoms and enhancing overall well-being.

Women with PMS often experience emotional, physical, and social difficulties due to impaired emotional regulation, leading to reduced quality of life. Niroomand et al. [13] conducted a randomized trial on 30 women with PMS to examine the effects of an eight-week Pilates program on emotion regulation and distress tolerance. The intervention group, which performed posture, breathing, and stretching exercises, showed greater improvement in emotional control, stress management, and coping ability than the control group. Similarly, in the present study, both groups benefited from Pilates-based training, supporting previous findings on the positive impact of Pilates in women with PMS.

Pilates, a low-impact physical activity focusing on flexibility, posture, and controlled breathing, has been suggested to alleviate PMS symptoms by improving circulation, promoting muscle relaxation, and reducing stress levels. In a quasi-experimental study conducted by Tejmalji et al. [25] on 231 adolescents, a six-week Pilates program similarly resulted in a significant reduction in the severity of PMS symptoms. These findings support the growing evidence that Pilates-based interventions can effectively relieve physical and emotional discomfort associated with PMS.

In a quasi-experimental study, Hassan Ahmed et al. [26] compared the effects of Pilates exercises and the Benson relaxation technique on PMS symptoms. The intervention lasted eight weeks, with participants in the Pilates group attending three 45–50-minute sessions per week, while the second group practiced the Benson relaxation method twice daily for 20 minutes. Both groups showed significant post-intervention reductions in total PMS scores; however, Pilates was found to be more effective in alleviating physical, behavioral, and psychological symptoms than the Benson relaxation technique. Similarly, in the present study, both the Pilates group and the Pilates + PFMT group achieved significant improvements in PMS scores, although the addition of PFMT did not produce a statistically greater effect within the eight-week period.

Women with PMS are known to experience disturbed sleep patterns and reduced sleep quality, particularly during the follicular and late luteal phases of the menstrual cycle, which negatively affects overall well-being. Sheerin Banu et al.[23] conducted a quasi-experimental study on 132 women with PMS to assess the effects of Pilates and breathing exercises on quality of life and sleep. Their results showed that both Pilates and breathing exercises improved quality of life (SF-36) and sleep quality (PSQI), with Pilates being more effective than breathing exercises alone.

Similarly, Samadi et al. [27] investigated the effects of Pilates and aerobic exercise on PMS symptoms in 60 non-athletic young women. After eight weeks of training (three 60-minute sessions per week), both exercise groups showed significant reductions in PMS severity compared with the control group. While physical symptoms improved similarly in both groups, greater reductions in psychological symptoms were observed in the Pilates group. Consistent with Samadi's findings, our study also demonstrated that both interventions were beneficial, even though adding PFMT to Pilates did not yield a superior outcome.

Pelvic floor–focused exercises have been shown to strengthen pelvic musculature and may contribute to reductions in pain and improvements in premenstrual symptoms and overall well-being. In the present study, although both intervention groups demonstrated significant improvements in pain, premenstrual symptoms, sleep quality, and quality of life, the addition of pelvic floor muscle training (PFMT) to the Pilates program did not result in statistically significant between-group differences. This finding may be explained by several factors. First, the eight-week intervention period may have been insufficient to induce substantial neurophysiological adaptations, particularly in relation to pelvic floor muscle function and central regulatory mechanisms. Second, Pilates-based exercise inherently incorporates core stabilization, controlled breathing, and coordinated pelvic floor activation, which may have elicited comparable neuromuscular and psychosocial benefits in both groups, thereby limiting the detection of additional effects attributable specifically to PFMT. Finally, the intensity and progression of PFMT embedded within the Pilates program may not have been adequate to produce measurable additive effects within the intervention timeframe. Taken together, these considerations suggest that longer intervention durations, higher PFMT dosage, or more targeted pelvic floor–specific training protocols may be required to clarify the potential supplementary effects of PFMT in women with PMS.

Limitations

This study has several limitations that should be considered when interpreting the findings. The relatively small sample size may have limited the statistical power to detect subtle between-group differences, particularly for secondary outcomes, and may reduce the generalizability of the results. In addition, although multiple outcomes were evaluated, no formal adjustment for multiple comparisons was applied; therefore, especially secondary outcome findings should be interpreted with caution.

The absence of statistically significant between-group differences may also be related to intervention-related factors, such as the duration and dosage of pelvic floor muscle training, as well as the sensitivity of the selected outcome measures to detect PFMT-specific effects. Furthermore, pelvic floor muscle strength was not quantitatively assessed, which limits conclusions regarding the direct physiological effects of pelvic floor muscle training.

Finally, the use of sequential allocation rather than full randomization represents a methodological limitation that may introduce allocation bias; however, outcome assessments were conducted by a blinded assessor, which partially mitigates this concern.

CONCLUSION

No statistically significant differences were observed between the Pilates and Pilates + pelvic floor muscle training (PFMT) groups in terms of quality of life and sleep quality, although both interventions were associated with meaningful post-intervention improvements. Within the scope of the present study, the addition of PFMT did not result in detectable between-group differences. Pelvic floor–focused exercises may therefore be considered a complementary component of exercise programs for women with premenstrual syndrome and should be further examined in future research.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Author Contributions

Osman Çoban contributed to the conception and design of the study, supervision of the research process, data interpretation, manuscript writing, and critical revision of the manuscript. Kübra Uslu contributed to data collection, implementation of the intervention program, and preparation of the master's thesis.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval

The study protocol was approved by the Non-Interventional Research Ethics Committee of Üsküdar University (Approval No: 61351342/October 2023-24).

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