

The Effect of a Mindfulness-Based Stress Reduction Program on Premenstrual Symptoms: A Randomized Controlled Trial

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Introduction: Premenstrual syndrome (PMS) is an important health problem that affects women of childbearing age. Mindfulness, a meditation practice that cultivates the acceptance of events as they occur in the moment without judgment, is a promising strategy to help women cope with PMS. This study aimed to test the efficacy of a mindfulness-based stress reduction (MBSR) program in decreasing premenstrual symptoms compared with a control group.

Methods: This study was a prospective, single-masked randomized controlled trial conducted between February and April 2022 with 90 university students. Participants were women between 20 and 30 years of age, scored at least 45 on the Premenstrual Syndrome Scale (PMSS), and were not receiving other treatments for PMS. Participants were randomized into experimental (MBSR) and control groups in a 1:1 allocation. MBSR was provided in 8 weekly sessions lasting 2.5 hours and a 6-hour silence retreat during week 6. Symptoms of PMS were evaluated with the PMSS at baseline and postintervention. Differences between groups were compared postintervention using analysis of covariance to correct for baseline scores. The study was registered at www.clinicaltrials.gov before the data collection process was initiated (NCT05191108).

Results: Of the 90 enrolled participants, 74 participants completed the study and postintervention assessment (37 in each group). Immediately postintervention, the women in the experimental group had significantly lower PMS symptoms than women in the control group (PMSS total score, 96.35 vs 123.02; $P < .001$). The effect size for the change in premenstrual symptoms was large (partial η^2 , 0.510). Specific symptoms measured by the PMSS subscales all showed significant reductions in scores in the MBSR group compared with the control group.

Discussion: A mindfulness stress reduction program was effective in reducing premenstrual symptoms. MBSR programs may be used as a therapy for PMS. Future studies should test MBSR in larger and more diverse groups of women with PMS.

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Keywords: midwife, mindfulness stress reduction program, nurse, premenstrual syndrome

INTRODUCTION

Premenstrual syndrome (PMS) is a common condition that includes many physical, behavioral, and psychological symptoms during the late luteal phase of the menstrual cycle, and the symptoms disappear within a few days of the onset of menstruation.^{1,2} Although the literature suggests that PMS has neurobiological origins, its etiology is not fully understood. According to Granda et al, PMS may be associated with increased inflammation related to low antioxidant levels.³

More than 40 million women worldwide experience PMS symptoms.⁴ In a systematic review and meta-analysis, Direkvand-Moghadam et al determined that the prevalence of PMS varies greatly among countries: Iran (98%), Pakistan (61%), Brazil (60%), China (21%), and France (12%).⁵ The reported prevalence of PMS in the United States ranges from

20% to 40%.⁶ A systematic review and meta-analysis of 18 studies of premenstrual symptoms in Turkey found that 52.5% of women, 59% of high school students, and 50.3% of university students experienced PMS.⁷

According to the International Classification of Diseases (ICD-10), Tenth Revision classification,⁸ the most common psychological symptoms of PMS are anxiety, depression, fatigue, irritability, and a tendency to cry, whereas physical symptoms include breast tenderness, swelling, weight gain, sleep disturbance, headaches, and backaches.^{1,9,10} Recurrence of these symptoms in each cycle and their effect on daily life activities negatively affect women's interpersonal relationships, social activities, family relationships, and quality of life.^{1,10} Because of the complexity of premenstrual symptoms, a holistic approach to symptom reduction has been explored. Women may adopt lifestyle changes, such as diet and sleep regulation, to cope with premenstrual symptoms. Alternative and complementary therapies, such as reflexology, Pilates, acupressure, music, and exercise, have shown promising results in premenstrual symptom abatement.^{1,11–15}

Mindfulness is defined as careful awareness of one's current physical and mental experience without judgment.¹⁶ Mindfulness meditation is a technique to practice mindfulness, which fosters increased awareness throughout the day. Through increased awareness of sensory events, emotional reactivity can be reduced, which has been shown to reduce negative experiences such as pain sensation.¹⁷ A result of mindfulness training is the understanding that most thoughts

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Quick Points

- ◆ Mindfulness is a meditative practice that has been shown to help with stress reduction, reduce pain, and improve coping.
- ◆ Participants in an 8-week mindfulness-based stress reduction program had improved premenstrual syndrome (PMS) symptoms compared with control participants.
- ◆ Improvements in physical and psychological PMS symptoms included depressive feelings, anxiety, fatigue, irritability, changes in appetite, sleep changes, and swelling.
- ◆ Mindfulness is an effective, easy, and inexpensive method to reduce PMS symptoms.

and feelings are transient and that these momentary experiences can be regarded as mental phenomena rather than reality; this allows one to let go of thoughts and feelings more easily.¹⁶ Studies have shown that mindfulness-based interventions have a positive effect on the experience of chronic diseases, incontinence symptoms, infertility, the control of menopausal symptoms, and sexual problems. Studies have also shown that mindfulness-based interventions can reduce stress, anxiety, and disease symptoms and increase psychological well-being and quality of life.^{18–22}

Although there are many studies testing complementary approaches to reducing PMS symptoms,^{1,11–15} only a limited number of small clinical trial studies have evaluated the effect of mindfulness-based stress reduction (MBSR) programs on PMS.^{14,23} The purpose of this study was to evaluate the effect of an MBSR program on physical and psychological PMS symptoms. The hypothesis was that an MBSR program will reduce women's PMS symptoms compared with a control group.

METHODS

Study Design

A prospective, single-masked, randomized controlled trial design was used.

Setting and Sample

The study was conducted among the female students (N = 250) in the midwifery department of the Faculty of Health Sciences of Kırklareli University between February 21 and April 30, 2022. G*Power software (version 3.1.9.3) was used to calculate the necessary sample size for the study. With an estimated medium to large effect size²⁴ of 0.70 based on a review of the literature,^{16,23} a double-sided hypothesis, $\alpha = 0.05$, power of 0.80, and a 1:1 allocation ratio, the minimum sample size was 68 participants (n = 34 for each group). To account for sample attrition after enrollment, the targeted sample size was 40 participants in each group.

Inclusion and Exclusion Criteria

Inclusion criteria were women aged between 18 and 30 years; fluency in reading and speaking Turkish; regular menstruation (between 21 and 35 days); a score of 45 or greater on the Premenstrual Syndrome Scale (PMSS); enrollment as a student at the midwifery department of Kırklareli University; living with family, in a dormitory, or alone; income level supported by family; and internet access.

Exclusion criteria were gynecological conditions (eg, abnormal uterine bleeding, uterine fibroids, ovarian cysts), hormonal methods of contraception or other hormonal treatments, chronic health conditions, anemia, a communication-related disability (eg, impaired hearing, speaking, or comprehension), current psychiatric treatment with pharmacotherapy or psychotherapy, any current pharmacologic or nonpharmacologic treatments of PMS (eg, acupressure, homeopathy, acupuncture, yoga, other forms of meditation, osteopathy, aromatherapy oils), and exercise for the purpose of relieving PMS symptoms.

Measures and Instruments

Demographic and Health Questionnaire: This form was developed by the researchers following a review of the literature. The form consisted of a total of 23 questions about the sociodemographic characteristics of the women and their menstrual cycle, presence of chronic diseases, menstrual symptoms, gynecological diseases, prior education about menstruation, and whether they used pharmacologic or nonpharmacologic methods to reduce PMS.^{11,25}

The PMSS: This scale, which was developed on the basis of Diagnostic and Statistical Manual of Mental Disorders (DSM) Third Edition, and DSM Fourth Edition, Text Revision, by Gençdoğan²⁶ to evaluate premenstrual symptoms, consists of 44 questions on a 5-point Likert-type scale. The scale has 9 subscales including depressive feelings, anxiety, fatigue, irritability, depressive thoughts, pain, changes in appetite, sleep changes, and swelling. PMSS involves a retrospective evaluation, asking the person whether they had symptoms within 1 week before menstruation. The scores on the scale range between 44 and 220. Higher scores indicate stronger PMS symptoms. PMSS scores are interpreted as follows: 44, no PMS symptoms; 45 to 103, mild PMS; 104 to 163, moderate PMS; and 164 to 220, severe PMS. Cronbach's α reliability coefficient is 0.75 for the total scale and between 0.75 and 0.91 for the subscales.²⁶ Written permission was obtained from Gençdoğan for the use of the scale. In the current study, Cronbach's α reliability coefficient was 0.97 for the total scale and between 0.73 and 0.93 for the subscales.

Data Collection and Procedure

Data Collection

Potential participants were provided a link to an online screening questionnaire created using Google Forms. This

link was announced to the students in the classroom and sent to WhatsApp groups. The beginning of the online form included information about the study and informed them that they could quit the study anytime. Participants provided informed consent before completing the rest of the form, which included the Demographic and Health Questionnaire and the PMSS instrument. To prevent bias, the screening questionnaire was evaluated by a researcher who had not received mindfulness training. Before randomization, we told potential participants who met eligibility criteria that we were conducting a study on PMS. No information was given about the MBSR program. None of the participants knew they would receive a possible treatment for PMS. Participants who met the inclusion criteria were randomly assigned to the MBSR and control groups using random number generator software (www.random.org). Group assignment was recorded by the researcher. After group assignment, the menstrual dates of participants were noted by the researcher.

PMSS Measurement

Enrolled participants were sent a link to complete the PMSS scale one week before their next expected menstrual period for the preintervention measurement of PMSS. After the 8-week intervention phase, all participants completed a postintervention PMSS one week before their expected menstrual period. Data were collected in the experimental and control groups separately.

MBSR Intervention

The program, prepared by a researcher who had received MBSR education, was administered to individuals via an online platform (Zoom video meetings). To avoid bias, the instructor did not meet the participants until the first online session. At the first session, participants were oriented to the MBSR program but were not given an expectation that the program would affect their premenstrual symptoms (single masked).

The MBSR program included 8 weekly sessions, each lasting 2.5 hours, with the exception of the sixth session, a 6-hour day of silent meditation. The MBSR sessions were scheduled to accommodate the participants' availability. Before the start of the program, a WhatsApp message was sent to the students to remind them about the schedule. The MBSR sessions were held on a day convenient for all participants. On the day of the MBSR program, a reminder message was sent to the participants 1 hour before start time every week. The MBSR session was repeated in the same week for the participants who could not attend the program that day. The content of the MBSR program is summarized in Table 1. Each session, participants began by sharing their experiences during the previous week. At the end of the first session, audio recordings were sent to each participant to let them listen to the meditations throughout the week. Every day during week, participants were reminded to do the meditations with text messages, sometimes with pictures and sometimes with a kind message. Each session included guided meditation practice as well as specific topics. Session content by week was as follows.

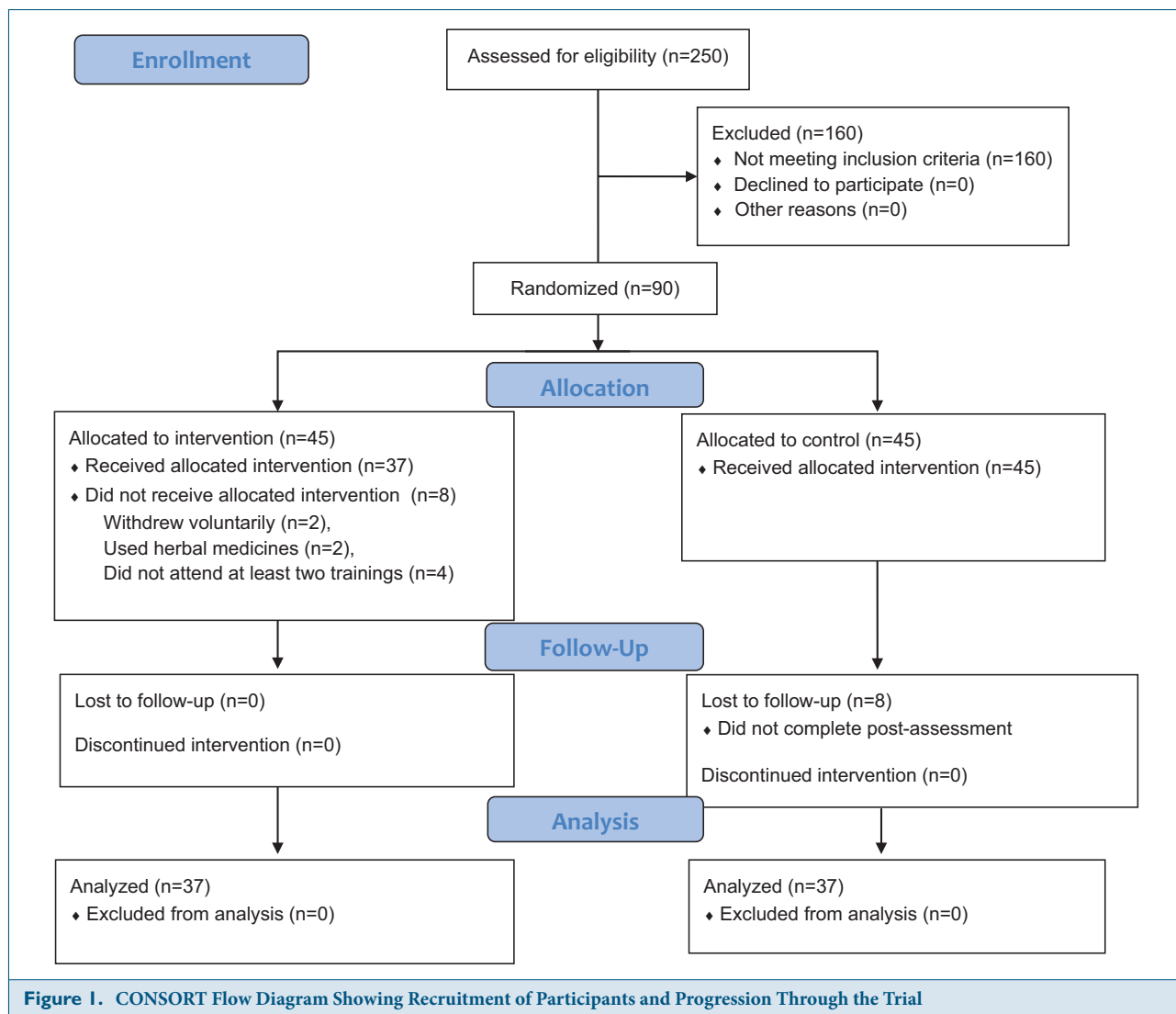
Table 1. Mindfulness-Based Stress Reduction Program Session Content

Week	Content	Meditations
1	Introduction to MBSR	Breathing awareness Mindful eating (raisin meditation)
2	Mindfulness practices	Sitting meditation Body scanning
3	Mindfulness practices	Breath-focused sitting meditation Body scanning
4	Presentation of stress	Talking about stress Presentation of the relationship between stress and body Coping with stress
5	Mindfulness practices and self-compassion	Mountain meditation Body scan Talking about self-compassion
6	Day of silence	Breathing awareness Mindful eating (raisin meditation) Breath-focused sitting meditation Body scanning Mountain meditation
7	Mindfulness practices	Sitting meditation Body scanning Communication exercise Mindful eating
8	Mindfulness practices and farewell	Self-compassion Sitting meditation Body scanning Talk about the importance of continuing the exercises

Abbreviation: MBSR, mindfulness-based stress reduction.

Week 1: Participants shared their PMS symptoms and experiences. Afterward, participants were given brief information about MBSR. Finally, students were guided in the breath-focused meditation and the raisin meditation. For the raisin meditation practice, 3 raisins were provided to the participants. The participants were asked to examine the first 2 raisins and experience their smell, shape, taste, and texture as if it were the first time. They were then asked to eat the raisins one at a time, noticing the difference in taste for each raisin.

Week 2: Participants were encouraged to share their experiences of using mindfulness and were taught the basics of communication (listening and speaking) and the body language practice. Body language is a communication technique. It is very important to notice the body's reactions in mindful communication. In this practice, the signs given by the body observed (sweating hands, faster breathing, relaxed shoulders). Then, participants were guided through activities, such as the body scan, 15-minute breathing-focused sitting meditation, improvement of environmental awareness, and mindful performance of daily activities (eg, eating, brushing teeth, taking a shower).



Week 3: Fifteen-minute breath-focused sitting meditation and body scanning activities were performed. Participants were encouraged to perform activities such as body scanning and mindful experience of normal daily routines once a day. In addition, the breathing-focused sitting meditation was encouraged to help participants increase awareness of reactions in their body to stress and other conditions.

Week 4: The session of this week included a 20-minute breathing-focused sitting meditation and didactic information about stress. Content included the definition of stress, the effect of stress on the body, recognizing responses to stress, and techniques for coping with stress.

Week 5: In this session, participants were taught the mountain meditation, body scanning, the relationship between stress and events, the definition of compassion and self-compassion, and the importance of self-compassion.

Week 6: The 6-hour day of silence was performed in 3 sessions, each of which took 2 hours. Participants were guided through the meditations and exercises they had learned in the first 5 weeks of the program. Activities during the day of silence included the 15-minute-long breathing-focused sitting meditation, raisin exercise, body scanning, environmen-

tal awareness, explaining the importance of thinking about the relationship between stress and responses, and accepting them without judgment. At the end of the day of silence, participants shared their experiences with each other.

Week 7: The activities of this week included sitting meditation, body scanning, communication exercises, raising awareness of communication styles, and sharing both compassion and self-compassion.

Week 8: The content of this week included the importance of self-compassion for human relationships, sitting meditation, body scanning, and identifying strategies for continuing a mindfulness practice.^{27,28} Participants were divided into groups of 2 and asked to remind each other to use their mindfulness skills by writing “mindful” every day.

Control Group

The control group was told that their participation in the study involved completing questionnaires about their PMS experiences and that they would not receive any treatment for PMS. The control group participants were contacted by email correspondence twice a week beginning 14 days

Characteristics	MBSR Group (n = 37)	Control Group (n = 37)
Age, mean (SD), y	20.95 (1.61)	21.03 (1.84)
Body mass index, mean (SD)	21.15 (3.38)	21.35 (3.21)
Accommodation, n (%)		
Dormitory	27 (70.3)	29 (78.4)
With family	7 (18.9)	4 (10.8)
Alone	4 (10.8)	4 (10.8)
Family type, n (%)		
Nuclear	24 (64.9)	31 (83.8)
Extended	11 (29.7)	5 (13.5)
Separated family	2 (5.4)	1 (2.7)
Income status, n (%)		
Low	17 (45.9)	7 (18.9)
Middle	17 (45.9)	29 (78.4)
High	3 (8.1)	1 (2.7)
Menarche age, mean (SD), y	13.51 (1.07)	13.35 (1.65)
Menstruation duration, mean (SD), d	5.76 (1.36)	5.35 (0.97)
Menstruation frequency, mean (SD), d	28.24 (4.53)	28.73 (1.91)
Family history of PMS, n (%)		
Yes	9 (24.3)	5 (13.5)
No	28 (75.7)	32 (86.5)
Having knowledge about menstruation, n (%)		
Yes	30 (81.1)	35 (67.6)
No	7 (18.9)	12 (32.4)

Abbreviations: BMI, body mass index; MBSR, mindfulness-based stress reduction; PMS, premenstrual syndrome.

before their menstrual period until their menstrual cycle began. The researcher asked them whether they had used any pharmacologic or nonpharmacologic methods to reduce PMS symptoms. Any participant who had used such methods was discontinued from study. After study completion, the participants in the control group were informed about MBSR, and they were offered the same MBSR program that was provided to the experimental group.

Human Subjects Protection

Approval for this study was obtained from the Firat University Research Ethics Committee (reference number: E-97132852-050.01.04-136946; date: January 1, 2022), written permission was obtained from Kırklareli University Health Sciences Faculty (reference number: E-73445267-199-40778, date: February 17, 2022), and the study was registered at www.clinicaltrials.gov (NCT05191108) before participant enrollment. After participants were informed about the purpose of the study, their written informed consent was obtained. All procedures were performed in accordance with the rules regarding studies involving human participants per the ethical standards of the institutional and national research committee and the 1964 Helsinki Declaration of Human Rights and its later amendments or comparable ethical standards. The participants were free to discontinue their participation at any stage. All personal data were han-

dled confidentially, and findings were only reported in the aggregate.

Statistical Analyses

Data were analyzed with IBM SPSS V23 (SPSS, Inc., Chicago, IL). Data were analyzed for normality using kurtosis and skewness.²⁹ The analysis of covariance (ANCOVA) test was used for comparing postintervention scores, adjusted for preintervention scores. The threshold for statistical significance was set at $P < .05$.

RESULTS

The initial study sample was made up of 250 students. Of those, 160 were excluded because they did not meet the inclusion criteria. The students were randomly allocated into the control group (n = 45) and the MRSP group (n = 45). See Figure 1 for the CONSORT flow diagram.

Table 2 shows the sociodemographic characteristics of the students. The majority of students lived in a city. At the time of the study, 74.3% of the participants were living in a dormitory. Many of the students had middle income. The average age of menarche was 13 years. Most of the participants did not have a family history of PMS. Most of the students (81.1%) had previously received education about menstruation.

Table 3. Premenstrual Symptoms at Baseline and Postintervention in MBSR and Control Groups (N = 74)

Variable	Group	Baseline Mean (SD)	Postintervention Mean (SD)	Adjusted		
				Postintervention Mean (SD) ^a	P Value	Partial η^2
Depressive feelings	Control	20.27 (6.07)	21.35 (6.39)	22.86 (6.51)	.001	.157
	MBSR	23.78 (5.09)	17.05 (6.47)	18.00 (6.00)		
Anxiety	Control	15.43 (6.13)	16.94 (6.64)	18.00 (4.31)	.001	.269
	MBSR	18.43 (6.47)	13.86 (5.57)	12.81 (4.31)		
Fatigue	Control	17.08 (6.22)	18.64 (5.93)	19.99 (4.20)	.001	.368
	MBSR	20.94 (5.08)	14.86 (5.32)	13.53 (4.20)		
Irritability	Control	13.45 (5.56)	14.13 (5.38)	14.69 (3.72)	.001	.301
	MBSR	15.40 (5.29)	10.43 (4.12)	9.88 (3.72)		
Changes in appetite	Control	8.83 (3.37)	9.81 (2.74)	9.93 (2.35)	.001	.171
	MBSR	9.27 (2.53)	7.94 (2.87)	7.83 (2.35)		
Sleep changes	Control	7.59 (3.33)	7.94 (3.01)	8.38 (2.28)	.001	.149
	MBSR	8.81 (2.44)	6.91 (3.08)	6.49 (2.28)		
Swelling	Control	7.94 (3.75)	8.13 (4.06)	8.07 (2.40)	.022	.071
	MBSR	7.78 (3.04)	6.70 (3.23)	6.77 (2.40)		
Total PMSS	Control	115.43 (37.40)	123.02 (35.15)	129.83 (19.80)	.001	.510
	MBSR	134.40 (31.58)	96.35 (27.21)	89.55 (19.80)		

Abbreviations: MBSR, mindfulness-based stress reduction; PMSS, Premenstrual Syndrome Scale.
^aAdjusted for baseline values using analysis of covariance.

Table 3 shows the baseline and adjusted postintervention scores on the PMSS total scale and subscales for the intervention and control groups. Participants in the intervention group had a significantly reduced PMSS total score corrected for baseline compared with the control participants (96.35 vs 123.02; $P < .001$). The effect size was large (partial η^2 , 0.510). Seven of the 9 subscales showed a statistically significant improvement in PMS symptoms for the intervention group, with the smallest effect for swelling (partial η^2 , 0.071) and the largest effect for fatigue (partial η^2 , 0.368). Because the interaction result of depressive thoughts and pain subdimensions was statistically significant ($P < .05$), the ANCOVA assumption could not be provided ($P = .036$; $P = .045$).

DISCUSSION

PMS, which results in physical and psychological symptoms, is a health problem that can have negative effects on daily living.¹ Women with PMS experience higher levels of life stress, and mindfulness-based approaches have the potential to help women with premenstrual symptoms.³⁰ This study demonstrated that MBSR reduced PMS syndromes. These findings are consistent with other studies in which PMSS levels declined in students after an MBSR program intervention.^{23,31,32} A controlled clinical trial ($n = 30$) 8-session cognitive disease-based mindfulness therapy reduced PMS symptoms and anxiety in university students through 3 months follow-up.³¹ In a similar small controlled trial ($n = 30$), Shabani and Khalatbari found that 8-session MBSR increased psychological well-being and improved emotion regulation in women.²³ Other studies have examined the effect of other types of mindfulness-based interventions

on PMS. A Mindfulness Training mobile app reduced the psychological, physical, and behavioral symptoms related to PMS and increased the quality of life of women in a controlled trial of 80 women between 25 and 40 years of age.³² Similarly, mindfulness-based cognitive-behavioral therapy has also been found to be effective in reducing PMS symptoms.^{1,33}

Mindfulness practices can beneficially affect the mind, autonomic nervous system, stress, immune system, and physical condition.³⁰ Mindfulness is a balanced sense of consciousness that helps individuals observe and acknowledge their emotions and physical experiences in the same way. Therefore, in PMS, mindfulness-based approaches can help patients feel and accept their emotions and physical symptoms such as headache and hip pain. While mindfulness helps the brain create positive emotions, it also has beneficial effects on immune function and alleviates depression.³⁰ Mindfulness can improve the physical and psychological health of women with PMS by encouraging the practice of muscle relaxation techniques and reducing aggravating physical responses to stress.³² In addition, mindfulness helps individuals to be fully aware of their thoughts and feelings, accept these feelings without judgment, and gain the ability to be calm and focused.³²

The current study had several limitations. The trial was conducted in a sample of students at a single university, limiting generalizability to other populations of women. The MBSR program was delivered synchronously online; findings may not transfer to in-person delivery or mobile applications. Future studies should test the effectiveness of MBSR in larger, more diverse samples of women with PMS and examine sustainability of the benefits through longitudinal follow-up.

CONCLUSION

MBSR is a noninvasive and inexpensive alternative and complementary method for women with PMS. Integrating MBSR into education or health programs offered to university students can facilitate the use of MBSR.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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