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Effectiveness of Mindfulness-Based Stress Reduction on Pain Self-Efficacy and Hope in Breast Cancer Patients

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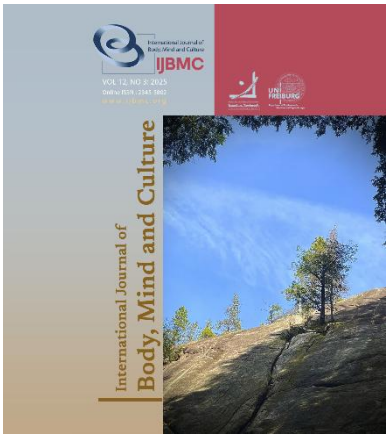

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ABSTRACT

Objective: This study evaluates the effectiveness of MBSR in improving pain self-efficacy and Hope in women with breast cancer.

Methods and Materials: This quasi-experimental study used a pretest-posttest design with a control group. The statistical population included breast cancer patients referred to Bazarganan Hospital, Tehran, in 2022. Thirty patients were purposively selected and randomly assigned to intervention (MBSR) and control groups (15 each). The MBSR intervention consisted of eight weekly 90-minute sessions, and data were collected using the Pain Self-Efficacy Scale and Snyder's Hope Scale at three stages: pretest, posttest, and two-month follow-up. Mixed-design ANOVA and Bonferroni post hoc tests were used for data analysis in SPSS-27.

Findings: MBSR significantly improved pain self-efficacy (P<0.001) and Hope (P<0.001) compared to the control group. These improvements were sustained at the two-month follow-up, indicating the intervention's long-term effectiveness.

Conclusion: The findings highlight the potential of MBSR as an effective complementary therapy for improving psychological outcomes in breast cancer patients. Clinicians and therapists are encouraged to integrate MBSR into supportive care programs to enhance patients' coping abilities and quality of life.

Keywords: hope, pain, self-efficacy, breast cancer, mindfulness.

Introduction

Breast cancer is among the most prevalent and life-altering diagnoses faced by women worldwide, presenting both physical pain and profound psychological challenges. Patients often endure distressing symptoms such as pain of varying intensities, anxiety about mortality, and concerns about the meaning and purpose of life (Alreda et al., 2022; Davoudi-Monfared et al., 2023). These challenges contribute to reduced psychological resilience and Hope, significantly impacting their overall quality of life (Al-Atiyyat et al., 2024; Antone et al., 2021). Addressing these multifaceted challenges requires holistic interventions that target both physical and emotional well-being.

Mindfulness-based interventions, particularly Mindfulness-Based Stress Reduction (MBSR), have

gained significant attention as third-generation cognitive-behavioral therapies. Originating from Buddhist practices, MBSR incorporates techniques such as meditation, body scanning, yoga, and mindful breathing to enhance moment-to-moment awareness and acceptance of thoughts, feelings, and physical sensations (Zernicke et al., 2016). This eight-week intervention, developed by Kabat-Zinn (1990), has demonstrated its efficacy in improving psychological and physiological outcomes in patients with chronic illnesses, including cancer (Zhang et al., 2019). Research highlights the role of MBSR in reducing stress, anxiety, and depression, while improving resilience, self-efficacy, and Hope in cancer patients (Alzahrani et al., 2023; Zhu et al., 2019).

Despite the growing evidence supporting MBSR, there remains a lack of research examining its application in the context of breast cancer patients in Iran. The unique cultural and psychological context of Iranian patients necessitates a localized exploration of MBSR's effectiveness. Furthermore, most existing studies focus on short-term psychological outcomes, leaving gaps in understanding its sustained impact on pain self-efficacy and Hope.

This study seeks to fill these gaps by evaluating the effectiveness of MBSR in improving pain self-efficacy and Hope in breast cancer patients. By addressing these critical outcomes, this research aims to provide evidence-based recommendations for integrating MBSR into supportive care programs for breast cancer patients, thereby enhancing their psychological and physical well-being.

Methods and Materials

Study Design and Participants

This quasi-experimental study employed a pretest-posttest design with a control group and a follow-up phase. The research aimed to evaluate the effectiveness of Mindfulness-Based Stress Reduction (MBSR) training on pain self-efficacy and Hope in women with breast cancer. The inclusion of a follow-up phase allowed for the assessment of the intervention's sustained effects, adding to the robustness of the study design.

The study population consisted of breast cancer patients referred to the oncology and radiotherapy department of Bazarganan Hospital in Tehran during the second half of 2022. A purposive sampling method was used to select participants meeting the inclusion criteria. Thirty participants were then randomly assigned to the intervention and control groups, with 15 individuals in each group. Inclusion criteria were Patients diagnosed with stage 3 and grade 2 breast cancer based on clinical findings, cytology studies, and physician evaluation, diagnosis made more than six months prior to the study, Patients undergoing chemotherapy, women aged 30 to 60 years and educational attainment of at least a high school diploma and fluency in Persian. Exclusion Criteria were acute psychiatric features determined through psychological screenings and clinical documentation, seizures, neurological diseases, or medical conditions affecting cognitive performance, consciousness disorders or inability to participate in sessions, active suicidal ideation or high risk of self-harm, lack of commitment to intervention attendance or follow-up, participation in parallel psychotherapy unrelated to the study, self-reported substance abuse or documented addiction in medical files and concurrent diagnosis of other cancer types.

To determine the sample size, G*Power software was used based on the components of alpha (α=0.05), statistical power (1-β= 0.90), effect size = 0.43, the number of groups= 2, and the number of measurements= 3 (pre-test, post-test, and follow-up). Accordingly, the sample size was determined to be 30 participants in two groups, who were randomly assigned into two experimental groups and one control group (15 participants in each group).

After obtaining the necessary permissions, and through coordination with the oncology and radiotherapy department of Bazarganan Hospital in Tehran, the patients' files were reviewed. Based on the inclusion and exclusion criteria of the present study and considering the possibility of patient participation, 45 female patients with breast cancer were selected for the present study. Participants were randomly assigned into two 15-member groups using a simple randomization method and a lottery. The intervention group received 8 weekly sessions of mindfulness-based stress reduction lasting one and a half hours each, while the control group was placed on a waiting list for intervention. The intervention program used in the present study was implemented based on theoretical discussions and practical exercises. During the follow-up phase, two

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months after the completion of the therapeutic interventions, the psychological status of the patients in both research groups was assessed using the research instruments for the variables (pain self-efficacy and Hope), and their scores were recorded. It should be noted that the implementation of the intervention and the evaluation tests in this study were conducted based on theoretical discussions and practical exercises.

Instruments

Pain Self-Efficacy Questionnaire: The Pain Self-Efficacy Questionnaire includes 10 items designed by Nicholas (2007) to assess patients' beliefs in their ability to perform various activities despite pain. Participants respond to the items on a 7-point Likert scale ranging from 0 = no self-efficacy to 6 = complete self-efficacy. Higher scores indicate stronger beliefs in performing daily activities despite pain. Its validity was calculated using convergent validity, with a correlation coefficient of -0.59 with the Beck Depression Inventory. The internal consistency of this scale in the original study was reported with Cronbach's alpha (α = 0.92). Asghari Moghadam and colleagues reported test reliability coefficients of 0.78, 0.81, and 0.77 using Cronbach's alpha, split-half, and test-retest methods, respectively, indicating satisfactory reliability. Furthermore, the Cronbach's alpha for this questionnaire was reported as 0.92 (Ebrahimkhani et al., 2024; Terzaki et al., 2023). In this study, the internal consistency of the present scale was obtained using Cronbach's alpha (α = 0.90).

Hope Questionnaire: The Hope Questionnaire, developed by Snyder et al. (1991), contains 12 items and aims to assess individuals' level of Hope. Its scoring is based on a 5-point Likert scale. This questionnaire, designed for individuals aged 15 and above, measures two subscales: agency and pathways. To calculate the total score of the questionnaire, the sum of the scores of all individual items is obtained. Higher scores indicate greater Hope in the respondent and vice versa. The minimum possible score is 12, and the maximum is 60. Scores between 12 and 24 indicate low Hope, 24 to 36 indicate moderate Hope, and above 36 indicate high Hope (Nasiri, 2022). The developers of the scale reported its validity as 0.61 and its reliability as 0.90 and 0.89 using Cronbach's alpha and split-half methods, respectively. Furthermore, the reliability of this questionnaire in the study by Kermani et al. (2011) was reported as 0.86 using Cronbach's alpha and 0.81 using the test-retest method (Hassanzadeh & Talebi, 2023; Zekri et al., 2024). It should be noted that in this study, the internal consistency of the present scale was obtained using Cronbach's alpha (α = 0.77).

Intervention

Mindfulness-Based Stress Reduction Intervention: The Mindfulness-Based Stress Reduction (MBSR) intervention included eight educational sessions designed in accordance with the MBSR training protocol by Jon Kabat-Zinn (2013) and was delivered step-by-step in eight weekly 40-minute sessions. The content of the educational sessions included: mindful eating, body scanning, meditation, mindfulness walking, yoga, awareness of breathing, body, sounds, and thoughts; introducing problematic thoughts and memories; three-minute breathing exercises; mindfulness and communication; meditation in nature; and breathing exercises for anger management, awareness, and compassion. The first session introduces participants to the foundational principles of MBSR, emphasizing mindfulness not just as a technique but as a way of life. The session includes experiential practices such as mindful eating, where participants focus attentively on the sensory experience of food, and a guided body scan that systematically brings awareness to different parts of the body, cultivating present-moment awareness and grounding. In the second session, the focus shifts to integrating gentle yoga postures to build physical awareness, along with practicing mindful interaction to enhance relational presence. This session also introduces seated meditation for 10 minutes, helping participants begin to observe thoughts and sensations without judgment. The third session builds on the prior practices, extending yoga routines and incorporating brief mindfulness exercises (5 minutes) to deepen the habit of moment-to-moment awareness, followed by a slightly longer sitting meditation of 15 minutes that emphasizes non-reactivity. In the fourth session, participants engage in yoga and explore mindfulness of various domains—breath, body, sounds, and thoughts—while also learning techniques to face and work with challenging emotions in a compassionate and accepting manner. The fifth session centers on emotional regulation, teaching mindful breathing as a strategy for managing anger and introducing participants to

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mindfulness of thoughts, promoting cognitive awareness and defusion. The sixth session combines yoga with compassion meditation, fostering self-kindness and empathy, and introduces mindfulness in nature, encouraging participants to extend their mindful awareness to outdoor environments and natural stimuli. The seventh session reinforces all prior practices by cycling through awareness of breath, body, sounds, thoughts, and revisiting compassion meditation, promoting emotional balance and deepened insight. The final session, session eight, reviews the entire program, providing a comprehensive summary of key practices and insights gained. It emphasizes how to apply mindfulness skills in everyday contexts to support long-term stress reduction, emotional regulation, and enhanced well-being, marking the formal conclusion of the intervention.

Data Analysis

In this study, statistical methods were used for data analysis at two levels: descriptive and inferential statistics. In descriptive statistics, the mean, standard deviation, variance, minimum, and maximum scores were used, and in inferential statistics, mixed repeated measures were employed. To analyze the data, the research data were first extracted, and all data were analyzed using SPSS-27 software.

Findings and Results

The results showed that the mean age in the MBSR group was 42.2 years, and in the control group, it was 43.93 years. The two groups did not show a significant difference under one-way ANOVA (P = 0.319). In the MBSR group, 26.7% had an associate degree, 46.7% a bachelor's degree, and 26.7% a master's degree. In the control group, 40% had an associate degree, 40% a bachelor's degree, and 20% a master's degree. Based on Fisher's exact test, the three groups were homogeneous in terms of educational distribution (P = 0.601).

Table 1

Pain Self-Efficacy in Research Groups During the Study

Variable	Group	MBSR Mean ± SD	Control Mean ± SD
Pain Self-Efficacy	Pre-test	18.07 ± 2.89	19.87 ± 2.64
	Post-test	23.60 ± 2.80	19.60 ± 2.53
	Follow-up	24.07 ± 2.52	19.33 ± 2.85
Hope	Pre-test	19.40 ± 2.41	19.27 ± 2.28
	Post-test	23.07 ± 1.83	19.47 ± 2.20
	Follow-up	22.53 ± 2.17	19.07 ± 2.31

The skewness and kurtosis of the research variables were within the acceptable range (-2 to +2), and none of the variables showed a severe deviation from normality.

Table 2

Shapiro-Wilk Test for Normality of Variables

Variable	Group	Time	Statistic (MBSR)	Sig. (MBSR)	Statistic (Control)	Sig. (Control)	Statistic (Overall)
Pain Self-Efficacy	Pre-test	0.929	0.263	0.926	0.239	0.969	0.257
	Post-test	0.967	0.810	0.953	0.580	0.955	0.077
	Follow-up	0.988	0.998	0.966	0.787	0.956	0.087
Hope	Pre-test	0.943	0.419	0.967	0.807	0.961	0.129
	Post-test	0.957	0.644	0.959	0.676	0.975	0.431
	Follow-up	0.970	0.859	0.883	0.053	0.969	0.264

Based on Table 2, the assumption of normality was accepted for all variables across the study and for each group, as the significance values were greater than 0.05. The assumption of equal variances (sphericity) between all group combinations was examined using Mauchly's test of sphericity. When sphericity was violated,

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corrections such as Huynh-Feldt adjustment were applied, as the epsilon coefficient in this method exceeded 0.5 and was the highest among other corrections. In the pre-test, post-test, and follow-up stages, the assumption of equal variances (Levene's test) was satisfied, as the significance value for each variable was greater than 0.05. Multivariate test results using Wilks' lambda showed significant differences among the three groups in pain self-efficacy over time and in time-group interaction (P<0.001).

Table 3

Repeated Measures ANOVA Results for Pain Self-Efficacy

Group	Source of Effect	SS	df	MS	F	P	Effect Size
MBSR	Within-subjects (stages)	334.178	1.333	250.772	61.703	0.001	0.81
	Error	75.822	18.656	4.064			
Control	Within-subjects (stages)	2.133	2	1.067	3.027	0.065	0.17
	Error	9.867	28	0.352			

Results in Table 3 indicate significant differences in pain self-efficacy between intervention stages in the MBSR group (P < 0.001). No significant differences were observed in the control group (P = 0.065). Bonferroni post-hoc tests were used to explore differences between intervention stages within each group.

Table 4

Bonferroni Post-Hoc Test for Pain Self-Efficacy

Group	Comparison	Mean Difference	Std. Error	Sig.
MBSR	Pre-Post	-5.533	0.307	<0.001
	Pre-Follow-up	-6.000	0.743	<0.001
	Post-Follow-up	-0.467	0.661	1.000
Control	Pre-Post	0.267	0.182	0.493
	Pre-Follow-up	0.533	0.274	0.215
	Post-Follow-up	0.267	0.182	0.493

Results in Table 4 indicate significant differences in the MBSR group between pre-test and post-test (P<0.001) and pre-test and follow-up (P<0.001), but no significant difference between post-test and follow-up (P=1.000). No significant differences were observed in the control group for any time comparisons. Further evaluations of interaction effects were performed, and between-group comparisons at each time point are shown in Table 5.

Table 5

Between-Group Multivariate ANOVA Results at Each Stage

Time	Source of Effect	SS	df	MS	F	Sig.	Effect Size
Pre-test	Between-groups	24.578	2	12.289	1.909	0.161	0.083
Post-test	Between-groups	194.711	2	97.356	16.999	<0.001	0.447
Follow-up	Between-groups	212.133	2	106.067	18.665	<0.001	0.471

Results in Table 5 indicate no significant differences between groups in the pre-test stage (P = 0.161). However, significant differences were observed in the post-test and follow-up stages (P < 0.001).

Table 6

Repeated Measures ANOVA Results for Hope

Group	Source of Effect	SS	df	MS	F	Sig.	Effect Size
MBSR	Within-subjects (stages)	117.733	1.373	85.774	59.720	<0.001	0.810
	Error	27.600	19.216	1.436			
Control	Within-subjects (stages)	1.200	2	0.600	0.677	0.516	0.046
	Error	24.800	28	0.886			

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Significant differences in Hope were observed between intervention stages in the MBSR group (P<0.001). No significant differences were observed in the control group (P=0.516). Bonferroni post-hoc tests were used for further analysis.

Table 7

Bonferroni Post-Hoc Test for Hope

Group	Comparison	Mean Difference	Std. Error	Sig.
MBSR	Pre-Post	-3.667	0.444	<0.001
	Pre-Follow-up	-3.133	0.401	<0.001
	Post-Follow-up	0.533	0.192	0.044
Control	Pre-Post	-0.200	0.368	1.000
	Pre-Follow-up	0.200	0.380	1.000
	Post-Follow-up	0.400	0.273	0.493

Results in Table 7 indicate significant differences in the MBSR group between pre-test and post-test (P<0.001), pre-test and follow-up (P<0.001), and post-test and follow-up (P= 0.044). No significant differences were observed in the control group for any time comparisons.

Discussion and Conclusion

The results of the present study indicate that participation in an eight-week Mindfulness-Based Stress Reduction (MBSR) program significantly enhanced both pain self-efficacy and Hope among breast cancer patients in the experimental group compared to the control group. These improvements were not only observed at the end of the intervention but were sustained at the follow-up assessment, suggesting the enduring effects of MBSR. Specifically, the increase in pain self-efficacy suggests that participants developed greater confidence in their ability to manage and live with pain resulting from their illness and its treatment. Simultaneously, the rise in Hope indicates a strengthened sense of purpose, goal orientation, and positive future outlook, which are especially critical in the psychological adjustment of cancer patients.

The improvement in pain self-efficacy observed in this study is consistent with prior research highlighting the capacity of MBSR to enhance individuals' coping abilities and reduce their perceived limitations in the face of chronic illness. For example, in a randomized controlled trial comparing MBSR and cognitive-behavioral therapy for chronic pain, both interventions were found to significantly increase self-efficacy and reduce pain-related distress in patients with chronic low back pain, reinforcing the role of mindfulness in empowering patients to manage their conditions more effectively (Turner et al., 2016). Our findings suggest that similar mechanisms are at play among breast cancer patients, where mindful awareness and non-reactivity to pain may reduce its emotional salience and promote a greater sense of control.

Furthermore, the significant rise in Hope among MBSR participants aligns with evidence that mindfulness interventions can foster existential resilience and adaptive goal setting. In a study of university students, MBSR was found to increase hope and academic hardiness, emphasizing the broader psychological benefits of mindfulness beyond symptom relief (Dortaj et al., 2020). While Dortaj and colleagues examined an academic population, the psychological mechanisms they described—such as increased present-moment awareness, reduced rumination, and emotional acceptance—are equally relevant to medical populations. For breast cancer patients, cultivating hope can act as a psychological buffer against despair, facilitating engagement in treatment and improved quality of life.

Our findings are also in line with the results of a systematic review and meta-analysis that evaluated the effects of MBSR on breast cancer symptoms. This review concluded that MBSR significantly improved psychological and physical outcomes, including distress, anxiety, and functional capacity, all of which are likely precursors to improved self-efficacy and hope (Castanhel & Liberali, 2018). The convergence of these findings supports the hypothesis that MBSR works through multiple pathways—reducing distress, enhancing emotional regulation, and fostering cognitive clarity—to

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improve patients' belief in their ability to cope and to maintain a meaningful vision for the future.

Additionally, recent studies on MBSR in breast cancer patients have demonstrated that the intervention has a significant positive effect on quality of life, psychological distress, and emotional regulation. Zhu et al. (2023) reported that MBSR effectively reduced negative affect and enhanced cognitive-emotional strategies in breast cancer patients undergoing early chemotherapy (Zhu et al., 2023). These findings are consistent with the present study's results, suggesting that the psychological benefits of mindfulness extend to both emotional processing and motivational constructs like self-efficacy and hope. The ability of MBSR to facilitate non-judgmental awareness likely plays a central role in improving emotional clarity, helping patients reinterpret their pain and future through a less catastrophic lens.

The results are also corroborated by Zhang et al. (2019), who conducted a meta-analysis revealing that MBSR significantly improved quality of life and decreased symptom severity in breast cancer patients (Zhang et al., 2019). Given that pain perception and emotional distress are strongly interrelated in oncology populations, the reduction in symptom distress reported in previous studies may have indirectly contributed to increases in self-efficacy and hope. Our findings, therefore, extend this literature by directly measuring these psychological outcomes and demonstrating that MBSR not only alleviates distress but also builds internal resources necessary for adaptive functioning.

Moreover, Aghdam et al. (2022) found that MBSR significantly enhanced post-traumatic growth and reduced death anxiety in breast cancer patients, indicating its role in fostering positive psychological transformation in the face of adversity (Aghdam et al., 2022). The parallel between reduced death anxiety and increased hope suggests that mindfulness facilitates a reorientation toward life goals and meaning, even in the context of life-threatening illness. This perspective may help explain the current study's finding that participants felt more hopeful about their future following mindfulness training.

In terms of psychological mechanisms, the findings are also supported by Safikhani (2022), who observed that interventions enhancing cognitive-emotional processing improved self-efficacy in mothers of children with autism spectrum disorder (Safikhani, 2022). While the populations differ, both studies support the idea that structured mental practices can cultivate an individual's belief in their ability to influence their life circumstances. Mindfulness, by encouraging intentional attention and emotional regulation, appears to offer a similar pathway toward enhancing self-efficacy and fostering psychological resilience in the face of challenging realities.

Together, these findings demonstrate that MBSR is a versatile and effective intervention for improving not only emotional well-being but also cognitive and motivational constructs that are essential for long-term adaptation in breast cancer patients. The gains in pain self-efficacy and Hope observed in this study add to the growing body of evidence supporting the use of mindfulness in oncology settings. As cancer treatment becomes increasingly holistic, addressing the psychological needs of patients is as crucial as managing their physical symptoms. MBSR offers a cost-effective, non-invasive, and patient-centered approach that aligns well with these integrative care models.

Despite its strengths, this study is subject to several limitations. First, the sample size was relatively limited, which may constrain the generalizability of the findings. A larger and more diverse cohort would help confirm the robustness of these results across different demographic groups and stages of illness. Second, reliance on self-reported measures may have introduced biases related to social desirability or participants' subjective interpretations of their experiences. Third, the absence of biological or behavioral markers limits our understanding of how psychological improvements translate into tangible health outcomes. Additionally, the follow-up period, though indicative of sustained effects, was relatively short; longer-term assessments would be necessary to determine the durability of the observed gains. Finally, participants' exposure to external psychosocial support or complementary therapies was not controlled for, potentially confounding the results.

Future research should aim to address these limitations by conducting larger randomized controlled trials with diverse populations to enhance external validity. Extending the duration of follow-up assessments would allow for examination of the long-term sustainability of MBSR's effects on pain self-efficacy and hope. Incorporating physiological measures such as cortisol levels, inflammatory markers, or neuroimaging

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data could provide a more comprehensive understanding of the intervention's impact. Future studies might also compare MBSR with other psychosocial interventions, such as acceptance and commitment therapy or meaning-centered therapy, to explore differential effectiveness. Additionally, qualitative studies exploring patients' subjective experiences of mindfulness could offer deeper insights into the mechanisms of change and inform the development of more tailored interventions. Researchers may also investigate whether specific components of MBSR (e.g., body scan, mindful movement) are more influential than others in enhancing psychological resilience.

Based on the findings of this study, healthcare providers should consider incorporating MBSR into standard psychosocial support programs for breast cancer patients. Oncology clinics and hospitals can offer MBSR groups as adjunctive interventions to help patients manage pain and cultivate psychological well-being. Training nurses, psychologists, and social workers in mindfulness-based interventions would facilitate broader implementation and accessibility. Simple adaptations, such as guided mindfulness sessions available through digital platforms or print materials, can make the practice more widely available for those unable to attend in-person sessions. Incorporating mindfulness education into patient orientation sessions or survivorship care plans could further normalize and encourage its practice. Ultimately, integrating MBSR into holistic cancer care models can enhance patient empowerment, support recovery, and foster a deeper sense of purpose during treatment and beyond.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional. This study, with the identifier IR.IAU.SARI.REC.1401.258, was approved by the Ethics Committee of the Islamic Azad University, Sari Branch, and registered in the Clinical Trial Registry with the number IRCT20230303057600N1.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contribute to this study.

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