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The effect of mindfulness-based art therapy (MBAT) on the body image of women with polycystic ovary syndrome (PCOS): a randomized controlled trial

Zahra Ramazanian Bafghi[1], Atefeh Ahmadi[2*], Firoozeh Mirzaee[2] and Masumeh Ghazanfarpour[1]

Abstract

Background The prevalence of polycystic ovary syndrome (PCOS) has increased in the last decade, resulting in enduring psychological effects, including negative body image. This study explored the effect of mindfulness-based art therapy (MBAT) on body image in women with PCOS.

Methods In a randomized, single-blind, controlled trial conducted in Kerman, Iran, women of reproductive age (18–45) who were diagnosed with PCOS and met specific inclusion criteria were randomly allocated to either the MBAT intervention group or a control group placed on a therapy waiting list. The main focus of the study involved evaluating alterations in body image scores as the primary measure. Additionally, the study assessed secondary outcomes, which encompassed various domains of the Multidimensional Body-Self Relations Questionnaire (MBSRQ) before, immediately after, and one month after the intervention. The trial is registered with www.irct.ir (Registration code (25/01/2020): IRCT20170611034452N9).

Results Between August 2020 and January 2021, 66 participants were randomly assigned to the MBAT or waiting list group, and the study was completed by 60 women. At the end of the intervention, body image (adjusted mean difference from baseline (AMD) of 29.22 [95% CI 19.54, 38.90], $P < 0.05$) and at the one-month follow-up (AMD of 34.77 [95% CI 24.75, 44.80], $P < 0.05$) were greater in the MBAT group than in the waiting list group. At certain time points, some MBSRQ domains, including body area satisfaction (BASS) ($p < 0.05$), appearance evaluation ($p < 0.05$), fitness orientation ($p > 0.05$), health orientation ($p < 0.05$), and self-classified weight ($p > 0.05$), had higher scores than did the control group. However, only BASS had a conclusive effect size (large). Additionally, appearance orientation ($p > 0.05$), illness orientation ($p > 0.05$), health evaluation ($p < 0.05$), fitness evaluation ($p > 0.05$), and overweight preoccupation ($p < 0.05$) had lower scores with variable and inconclusive effect sizes.

Conclusions The MBAT has potential as an effective approach for enhancing body image in women with PCOS. However, some MBSRQ domain results were inconclusive, likely due to the small sample size. Therefore, further research with a larger sample size is recommended.

*Correspondence:
Atefeh Ahmadi
atefeahmadi59@gmail.com; a.ahmadi@kmu.ac.ir

Full list of author information is available at the end of the article

Keywords Polycystic ovary syndrome, Body image, Mindfulness, Art therapy, Mindfulness-based art therapy, Mindfulness-based interventions

Introduction

Polycystic ovary syndrome (PCOS) is a complex and multisystem endocrine disorder that affects reproductive, metabolic, and psychological health in individuals from adolescence to menopause [1, 2]. PCOS is a growing global public health concern, with increasing prevalence rates, greater disability burdens, and variations among countries [3]. In Iran, 13.6%, 19.4%, and 17.8% of the population had PCOS according to the diagnostic standards of the NIH, Rotterdam, and AE-PCOS Society, respectively [4].

Studies have shown that patients with PCOS report more negative body image (BI) results than healthy people do [5–7]. BI is defined as the mental image of the body and the attitude toward oneself, appearance, health, integrity, normal functioning, and gender of the individual. BI is a multidimensional structure that refers to people's perceptions and attitudes, including feelings, thoughts, and behaviors related to their body and appearance [8]. Many clinical features of PCOS, such as hirsutism, obesity, irregular menstruation, and infertility, are associated with body dissatisfaction [9]. Individuals with PCOS who have a negative perception of BI often experience consequences such as dissatisfaction with their appearance; loss of femininity and sexual attractiveness; anxiety; depression; reduced healthy behaviors; and negative impacts on their lives [10–12].

Numerous studies have suggested that the use of mindfulness-based stress reduction (MBSR) or art therapies can improve BI in various populations [13–15]. Integrating these approaches into mindfulness-based art therapy (MBAT) could have a substantial impact. Although MBSR is technique-based, combining it with art therapy enhances its appeal, as it can enhance present-moment engagement and foster attention regulation, body awareness, and emotional regulation [16–18]. MBAT can be particularly engaging and therapeutic for individuals who might not respond as well to traditional talk therapies, and it can help in accessing and processing emotions that are not easily articulated [19]. This engagement can be crucial for women with PCOS, who might experience fatigue [20] or lack motivation [21] due to their condition.

The rationale for selecting MBAT as an intervention method in the present study over other evidence-based behavioral therapies, such as cognitive behavioral therapy (CBT) and acceptance and commitment therapy (ACT), is based on the following considerations: While CBT and ACT have been shown to be effective at addressing body image issues [22], they might not be as engaging or holistic as MBAT for improving BI in women with PCOS. Notably, women with PCOS often experience alexithymia [7], anxiety, and depression [5], which can affect their body image [23, 24]. In this context, CBT focuses primarily on cognitive restructuring, which might not fully address the emotional and sensory experiences [25] related to body image and related factors. On the other hand, ACT emphasizes acceptance and mindfulness [26] but lacks the creative, expressive component of art therapy. MBAT has the potential to enhance mental and physical well-being by simultaneously engaging and reorganizing various biological and behavioral processes, offering a promising biobehavioral approach for reducing anxiety, depression, and other psychological symptoms and disorders while mitigating daily stress and improving quality of life, especially in chronic medical conditions [17, 27–30]. Therefore, incorporating stress-focused methods with art therapy could provide a comprehensive approach to addressing BI issues, considering their links to psychological distress.

This study aimed to evaluate the effect of the MBAT on the BI in adult women of reproductive age with PCOS. It was hypothesized that participants in the MBAT would demonstrate improvement in BI and that their scores in the Multidimensional Body-Self Relations Questionnaire (MBSRQ) domains would increase after the intervention and at the one-month follow-up compared with those in the waiting-list control group.

Methods

Study design and participants

The present study employed a single-blind, two parallel-armed randomized controlled trial to investigate the effect of the MBAT on the BI of women of reproductive age with PCOS in Kerman, Iran. The trial received approval from the Research Ethics Committees of Kerman University of Medical Sciences (Approval code: IR.KMU.REC.1398.485), and registration was completed on the Iranian clinical trial website (Registration code (25/01/2020): IRCT20170611034452N9).

Following approval from the Ethics Committee of Kerman University of Medical Sciences, eligible participants who met the inclusion criteria were selected through convenience sampling involving referrals from healthcare centers affiliated with Kerman Medical Sciences and established women's and midwifery clinics in Kerman. After providing informed consent, a baseline assessment with two instruments (the demographic checklist and MBSRQ) was started. Ultimately, eligible individuals were randomly assigned to two groups: the control group and the intervention group.

The presence of PCOS was confirmed through a review of medical records and by obtaining a diagnosis verification from the respective gynecologist. This confirmation adhered to the Rotterdam criteria [31], which state that a patient can be diagnosed with PCOS if they meet at least two of the following three criteria: (1) Irregular or infrequent ovulation (oligo-anovulation), (2) Clinical and/or biochemical signs of excess androgen; (3) The specific ovarian morphology was characterized by multiple small cysts (polycystic ovarian morphology). Any uncertainties were resolved through consultation with project colleagues, including the supervisor and advisor professors. Recruitment commenced in November 2020, and the study, along with follow-up assessments, concluded in April 2021.

The inclusion criteria for the study participants were as follows: (1) diagnosis of polycystic ovary syndrome based on the Rotterdam criteria by a gynecologist; (2) women (single or married) aged between 18 and 45 years; (3) nonpregnant and not breastfeeding; (4) no use of psychiatric or psychoactive medications or any medication with psychological side effects within the 60 days preceding the intervention; (5) absence of other physical or mental illnesses recorded in the participant's medical records; (6) no alcohol, drug, or psychoactive substance use by the participant; (7) willingness to participate in counseling sessions; and (8) nonparticipation in concurrent or prior counseling sessions for body image other than this study.

The exclusion criteria for the study included individuals who met the following conditions: (1) became pregnant during the course of the research, (2) did not participate in two or more counseling sessions, (3) lacked the willingness to continue participating in the study during its execution, and (4) had any acute stress-inducing events during the intervention.

Estimation of sample size and sampling process

The sample size for each group was determined via the following formula for comparing two means:

$$n_1 = n_2 = \frac{({S_1}^2 + {S_2}^2)(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2}{(\bar{X}_1 - \bar{X}_2)^2}$$

In this formula, S1 represents the standard deviation (SD) of the intervention group after treatment, and S2 represents the SD of the control group after treatment, with values of 0.90 and 0.75, respectively, based on Jalilian et al.'s study [32]. Similarly, X1 denoted the mean of the intervention group after treatment (0.94), and X2 was the mean of the control group after treatment (0.11). $Z_{1-\frac{\alpha}{2}}$ equaled 1.96, and $Z_{1-\beta}$ equaled 0.84.

By using the provided equation, the calculated sample size for each group was approximately 17 participants. To bolster the study's statistical power to 80% and accommodate possible attrition, a group of 30 individuals was selected. As the research entailed two distinct groups, the overall projected sample size was 60 individuals.

Randomization and masking

After providing informed consent and conducting the baseline assessment, the participants were randomly assigned to two groups at a 1:1 ratio. The randomization process was executed via the random number table method. Each participant was assigned a unique code by an individual external to the research team. Following this, one of the researchers, with closed eyes, randomly chose participants from the table by initiating the selection process with the tip of a pen and proceeding in the direction of either rows or columns.

The intervention group underwent MBAT for counseling, whereas the control group was placed on a waiting list without intervention. To ensure minimal interaction and information exchange between the two groups, there were no scheduled meetings or communications between the intervention and control groups throughout the research duration. After completing their follow-up assessment, participants in the wait-listed condition were offered the chance to engage in complimentary MBAT sessions.

The randomization process aimed to reduce potential biases, and efforts were made to uphold ethical considerations related to participant allocation. The specific procedures for managing the control group during the waiting period were provided, ensuring consistency and transparency in the study design. The assessors and the statistical analysis team were kept unaware of the treatment allocation. Due to limitations in terms of the intervention methods, participants and researchers could not be blinded. Nevertheless, we ensured that the outcome assessors and the statistical analysis team were blinded to the conditions to minimize bias. To achieve this, we labeled the MBAT group as 'Code 1' and the control group as 'Code 2.'

Procedures

The intervention group underwent eight online MBAT sessions, each lasting 90–120 min, which were delivered twice a week over a period of four weeks. To ensure that the sessions were effective and manageable, the participants were divided into smaller groups [33]. Each MBAT session was organized with a maximum of 8 participants per group. Conversely, the control group remained on a waiting list and received no intervention. After completing their follow-up assessment, participants in the wait-listed condition offered the chance to engage in free MBAT sessions.

The development of the MBAT sessions drew inspiration from studies conducted by Monti et al. [29] and Jang et al. [30] (Table 1). A Master's student in counseling in midwifery who was trained in the MBAT conducted the sessions online. The accuracy of the implementation of the MBAT intervention was ensured under the supervision of an experienced psychological therapist. The participants received audio exercise instructions via WhatsApp for daily home practice, complemented by specialized music during the sessions. The questionnaire was completed through online links. To ensure effective technique execution, daily practice instructions (minimum of 45 min) were shared via WhatsApp. Sessions fostered group discussions, emotional expression, and the incorporation of prior assignments. Unfinished tasks resulted in double assignments in the following session.

Outcomes

The primary efficacy outcome measure was the change in the BI score from baseline to the endpoint between the two groups.

The secondary outcomes were changes in the MBSRQ domains (appearance evaluation (AE), appearance orientation (AO), fitness evaluation (FE), fitness orientation (FO), health evaluation (HE), health orientation (HO), illness orientation (IO), body area satisfaction (BASS), overweight preoccupation (OP), and self-classified weight (SW)).

Measurements

In this study, two questionnaires were employed to fulfill the research objectives:

Table 1 Overview of the content of mindfulness-based art therapy sessions

Session	Content	Homework
1	• Introduction to PCOS, body image, MBAT • Mindful Body Scan Meditation (Focused on Areas Affected by PCOS) • Mindful Self-Image Artwork	• Mindful Body Scan Meditation
2	• Feedback on previous assignments • Mindfulness of Painting Tools • Embodied Breath Meditation • Imagining Self-Care Based on Self-Image • Mindful Eating Exercise	• Embodied Breath Meditation • Mindful line drawing with colored pencils
3	• Feedback on previous assignments • Creative Expression Through Collage Art (Creative Expression Through Collage Art) • Exploring Stress and Mindful Art Reflection • Self-Exploration Mindfulness Exercise: "Who am I?" (Tailored to PCOS Experiences)	• Mindful Collage Creation • Exercise: "Who am I?"
4	• Feedback on previous assignments • Mindful Visualization of Health and Pleasure (Focusing on PCOS Well-being) • Mindful Story Awareness Exercise (Connecting to Personal Health Narratives- mini story with body image theme)	• Mindful Visualization of Health and Pleasure • Mindful Reading of Personal Choice Literature
5	• Feedback on previous assignments • Mindful Walking Practice • Mindful Awareness with Music • Mindful Writing Practice (Expressive Writing for PCOS Well-being + Writing a Letter to My Body)	• Mindful Song Listening • Mindful Walking Practice
6	• Feedback on previous assignments • Mindful Film watching (Body Image Themes) • Mindful Body Scan Meditation (Focused on Areas Affected by PCOS)	• Mindful Body Scan Meditation • Taking Mindful Photographs: Initially, capturing a pleasurable scene, followed by a mindful focus on self-portraiture
7	• Feedback on previous assignments • Loving-Kindness Meditation (Incorporates reflections on experiences with PCOS-related stigma, fostering a compassionate mindset toward oneself and understanding the impact of external perceptions.) • Mindfulness through Poetry • Embodied Breath Meditation	• Loving-Kindness Meditation • Creating a Body Image with Small Pieces of Colored Paper or Colored Paper Cutouts • Creating a Mandala Art Piece
8	• Feedback on previous assignments • Mindful Body Yoga Practice (Tailored yoga exercises incorporating gentle movements and poses to address common physical symptoms of PCOS, such as promoting hormonal balance, managing stress, and enhancing overall well-being) • Mindful Self-Image Artwork • Reflective Group Sharing and Session Summary	N/A

Demographic and health information Checklist: This checklist collects demographic information encompassing variables such as education, marital status, type and duration of infertility (infertility, defined as the inability to conceive after one year of regular, unprotected intercourse [34]), acne, occupation, and menstrual status (irregular menstruation was defined as having menstrual cycles that are less than 21 days or more than 45 days between 1 and 3 years post menarche, less than 21 days or more than 35 days, or fewer than 8 cycles per year more than 3 years post menarche up to perimenopause, any cycle lasting more than 90 days more than 1 year post menarche, or primary amenorrhea by age 15 or more than 3 years post thelarche (breast development [35]), exercise history (regular exercise in the past three months), family history of PCOS, scars (history of conditions or illnesses affecting physical appearance, e.g., breast surgeries, etc.), age, height (cm), weight (kg), age at menarche, marriage duration (years), number of pregnancies, number of children, illness duration (months), infertility duration (years), and hirsutism (assessed using the Ferriman–Gallwey score [34] with the aid of a visual guide).

MBSRQ: The MBSRQ is designed to assess individuals' attitudes toward various dimensions of their BI. This questionnaire, developed by Cash, comprises 69 items and 10 subscales evaluating the following domains [36]: AE (7 items) assesses satisfaction with overall physical appearance; AO (12 items) measures the importance placed on appearance and grooming; FE (3 items) evaluates perceptions of physical fitness and activity levels; FO (13 items) assesses the importance of physical fitness in one's lifestyle; HE (6 items) measures perceptions of physical health and freedom from illness; HO (8 items) evaluates commitment to a healthy lifestyle; IO (5 items) assesses responsiveness to and concern about physical symptoms; BASS (9 items) measures satisfaction with specific body areas; OP (4 items) addresses concerns related to weight, dieting, and eating behavior; and SW (2 items) reflects self-perception and classification of one's weight.

The questionnaire employs a 5-point Likert scale ranging from "Very Dissatisfied" to "Very Satisfied," with corresponding scores ranging from 1 to 5. The scoring system was designed to assign higher scores to individuals with more positive BI. In a study conducted in Iran by Zarshenas et al., the internal consistency of the MBSRQ subscales was found to be acceptable, with Cronbach's alpha values ranging from 0.70 to 0.87 [37].

Statistical analysis

The data were analyzed via Stata version 14.0, which was developed by Stata Corp. LLC in Texas, USA. Categorical data are described using absolute and relative frequencies, whereas quantitative data are characterized using means and standard deviations (SDs). When comparing baseline characteristics between groups, we followed the Imbens and Rubin approach and considered a standardized mean difference of less than 0.25 for continuous quantitative variables and a risk difference index of less than 10% for qualitative variables [38].

In this study, we used a complete case analysis approach, including only participants who completed all the study sessions. Since none of the auxiliary variables were significant according to Little's test [39] ($p<0.05$), we considered our missing data pattern to be missing completely at random (MCAR). Additionally, we had a 9.9% rate of missing data, and we accounted for up to this percentage of attrition when the sample size was calculated.

To examine the primary outcome, an analysis of variance and covariance (ANOVA/ANCOVA) was used to identify discrepancies in all the data, with the baseline score considered a covariate (one factor, one covariate). To gauge the impact of the pretest on the results and compare the two analysis models, we calculated the partial eta2 effect size. A change of more than 10% in the partial eta2 between the two analysis models was regarded as important.

Before conducting ANOVA/ANCOVA, we assessed the assumptions. While most variables displayed a normal distribution, certain variables did not adhere to this assumption, as anticipated. Given that the sample size exceeds 30, this nonnormality does not introduce bias into the analyses because of the central limit theorem. Various effect size measures, including the partial eta square, mean difference (MD), and Cohen's d-based standardized mean difference (SMD), were employed. Cohen's d values in the range of 0.2–0.5 indicate a "small" effect, 0.5–0.8 signify a "medium" effect, and values surpassing 0.8 denote a "large" effect. Interpretation of partial eta-square effect sizes falls into categories: 0.010–0.059 for a "small" effect, 0.060–0.139 for a "medium" effect, and greater than 0.140 for a "large" effect [40]. Effect sizes were reported with 95% confidence intervals (CIs), and statistical significance was determined at levels less than 0.05.

Protocol amendment

The original registration for this randomized controlled trial study titled "Comparison between the Effect of Counseling Based on Rational-Emotional-Behavior Theory (REBT) and the MBAT on the BI of Women with PCOS" underwent a protocol amendment because of the unforeseen impact of the COVID-19 pandemic. When the research team was preparing to start enrolling participants, the COVID-19 pandemic began. Consequently, the research team addressed the challenges encountered

during participant recruitment and intervention delivery. To ensure successful study sampling, the team adjusted the study's aim, removing REBT as a method. The study focused solely on the impact of the MBAT intervention on the body image of women with PCOS.

In response to pandemic restrictions and to ensure participant safety, the intervention was adapted for online delivery. Video conferencing platforms were utilized for remote MBAT sessions. The participants received detailed guidelines, and their progress was closely monitored during online sessions to maintain intervention integrity and consistency. To accommodate these modifications, a revised sample size calculation was conducted to ensure statistical power and account for the updated study design.

As an administrative error in the initial section of our protocol, we incorrectly stated the study type as "quasiexperimental". This was an error, and we want to emphasize that we are not misleading. Additionally, in subsequent sections of the protocol, we have clarified that the study is indeed randomized. We acknowledge that the trial registry entry does not mention secondary outcome measures—the domains of the Multidimensional Body-Self Relations Questionnaire—while we mentioned this in our research proposal, and we agree that we should have added more details to the entry.

Results

Sample characteristics

Between August 2020 and January 2021, of the 101 patients screened for the trial, 66 were eligible, provided informed consent and were randomly assigned to two groups (32 to the control group and 34 to the intervention group). Six patients withdrew their data from the study after group allocation, and 30 patients in each group completed the study (Fig. 1). Two people from the intervention group and 4 people from the control group dropped out: 1 person from the intervention group due to severe COVID-19, 1 person due to an unfortunate accident, and 4 people from the control group due to an unwillingness to complete the questionnaire. The test was excluded from the study.

The participants' demographic and health characteristics are presented in Table 2. The differences between the two groups in terms of clinical and demographic characteristics based on the proposed method of Imbens and Rubin [38] were inconsiderable.

Outcomes

Primary outcome

According to the crude model analysis, the average BI values at postintervention and at the one-month follow-up were significantly different between the groups ($P<0.05$, as indicated in Table 3). In the context of ANCOVA, after adjusting each measurement to its corresponding baseline, the partial eta2 values improved by >10%.

Secondary outcomes

Tables 4, 5 and 6 show the MBSRQ domains and summary scores after the intervention and at the one-month follow-up. ANCOVA was used to adjust for baseline differences in each measurement. Across both time points, all scores were greater within the MBAT group than in the control group, with exceptions noted for AO and IO postintervention, FE score after follow-up, and HE and OP at both measurements. Notably, only the differences in HE postintervention; OP after follow-up; and AE, HO, and BASS at both time points reached statistical significance.

Discussion

The present study aimed to evaluate the efficacy of MBAT compared with a waiting-list control group for women with PCOS in Iran. Compared with those in the control group, women who received MBAT improved their overall BI scores, and these effects were sustained at the one-month follow-up, with a conclusive result. Some MBSRQ domains demonstrated improvements with different effect sizes, with some suggesting enduring changes in BI domains through the MBAT, particularly in the BASS, whereas others remained inconclusive. To the best of our knowledge, this is the first experimental study to assess the impact of the MBAT on the BI in PCOS patients.

In general, the results indicate that participants in the MBAT group experienced greater BI than did those in the waiting list group did, even after adjusting for baseline measurements. The standardized mean differences revealed improvements in the BI with a large effect size, providing conclusive evidence at both time points.

Some MBSRQ domains, such as the SW and FO domains, showed improvements with small effect sizes. However, at the follow-up assessment, HO and FE displayed more substantial improvements with medium effect sizes, albeit the results were inconclusive. This finding suggested that the benefits of MBAT may extend beyond immediate effects, potentially leading to more enduring changes in MBSRQ domains. Notably, HO at follow-up, along with AE and BASS at both time points, exhibited considerable improvements with large effect sizes. Notably, the BASS results were conclusive, indicating the potential of the MBAT as a meaningful intervention for enhancing satisfaction with specific body areas. Conversely, OP postintervention and HE at both time points showed lower score with small to medium effect sizes, and even OP

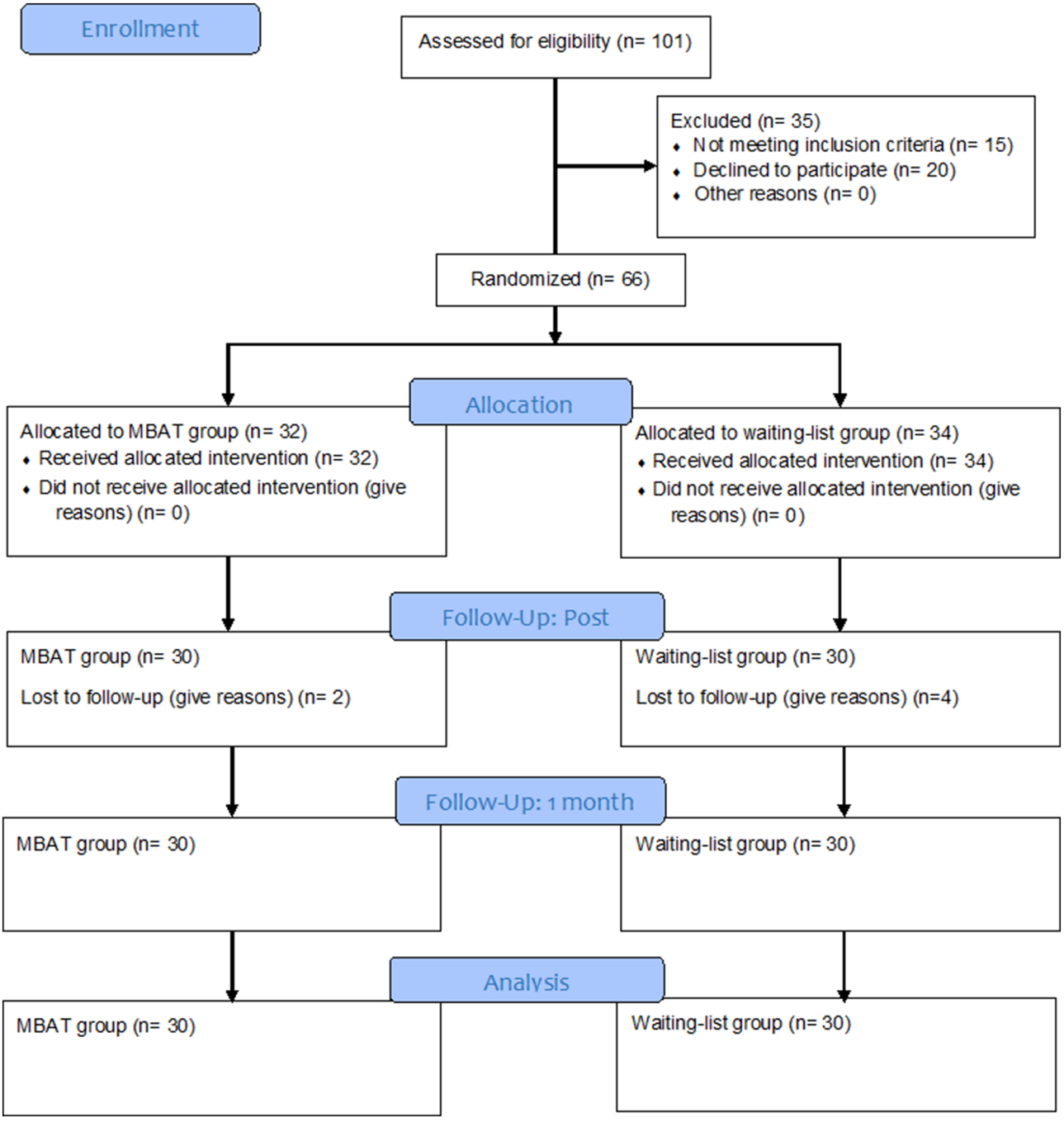

Fig. 1 Flow chart of the study

at follow-up exhibited a large effect size; however, all the effects remained inconclusive.

The MBSRQ domains demonstrating improvement indicate that MBAT was effective in enhancing participants' satisfaction with their body areas, overall appearance evaluation, and health orientation. These positive changes underscore the potential cognitive (e.g., improved perceptions of body areas and health), behavioral (e.g., increased focus on healthful behaviors), and emotional (e.g., reduced concern about weight) benefits associated with the MBAT. Conversely, the domains with inconclusive or non-significant results indicate variability in the effects of the MBAT on different aspects of BI. For example, the lack of significant changes in fitness-related domains may indicate that although MBAT positively influences body satisfaction and health orientation, it may not directly impact fitness behaviors or perceptions.

Table 2 Demographics and clinical characteristics of the participants

Qualitative variables		Intervention group (*N* = 30)		Comparison group (*N* = 30)	
		N	%	*N*	%
Education	Diploma and below	12	40	12	40
	Bachelor's degree	9	30	14	46.7
	Master's degree	7	23.3	4	13.3
	Doctorate	2	6.7	0	0
Marital status	Married	14	46.67	15	50
	Single	16	53.33	15	50
Infertility	None	23	76.7	24	80
	Primary	4	13.3	5	16.7
	Secondary	3	10	1	3.3
Acne	Presence	27	90	30	100
	Absence	3	10	0	0
Occupation	Unemployed	14	46.7	16	53.3
	Employed	16	53.3	14	46.7
Menstrual status	Regular	4	13.3	6	20
	Irregular	26	86.7	24	80
Exercise	Regular	6	20	4	13.3
	Irregular	24	80	26	86.7
Family history of PCOS	Positive	15	50	15	50
	Negative	15	50	15	50
Scar	Presence	8	26.7	6	20
	Absence	22	73.3	24	80
Quantitative variables		Mean	SD	Mean	SD
Age		27.63	6.82	26.43	5.43
Height (cm)		160.60	4.87	161.56	5.27
Weight (kg)		64.60	12.91	66.28	10.81
BMI (kg/m2)		25.08	4.90	25.42	4.15
Menarche age		13.23	1.56	12.76	1.13
Marriage duration (year)		4.16	5.13	3.30	4.51
Number of pregnancies		0.50	1.00	0.36	0.88
Number of children		0.30	0.65	0.23	0.56
Illness duration(month)		59.86	43.86	59.53	51.04
Infertility duration (year)		1.16	2.46	0.73	1.63
Hirsutism (Ferriman-Gallwey score)		16.26	7.31	17.13	7.13

Table 3 Distribution of primary outcomes according to two arms in addition to related effect sizes

Outcome	Model	Time point	Intervention (*n* = 30)		Control (*n* = 30)		MD [95% CI]	P value	SMD [95% CI]	Partial eta^2
			Mean	SD	Mean	SD				
Body image	Crude	Baseline	222.23	29.10	230.53	29.10	-8.3[-23.34, 6.74]	0.274	-0.29[-0.79, 0.22]	0.021
		Postintervention [a]	247.03	29.50	224.4	29.50	22.63[7.39, 37.88]	0.004	0.77[0.24,1.29]	0.132
		Follow-up [a]	251.43	29.61	223.13	29.61	28.30[13,43.60]	< 0.001	0.96[0.42,1.49]	0.191
	Adjusted	Postintervention [b]	250.33	18.62	221.11	18.62	29.22[19.54,38.90]	< 0.001	1.57[0.98,2.14]	0.391
		Follow-up [b]	254.67	19.30	219.90	19.30	34.77[24.75,44.80]	< 0.001	1.80[1.19,2.40]	0.458

MD: mean difference; CI: confidence interval; SMD: standardized mean difference (based on Cohen's d test); ANOVA: analysis of variance; ANCOVA: analysis of covariance

*Expressed as the mean ± standard deviation. The baseline, postintervention and follow-up values represent the results of the participants' assessments before and after the intervention and at the one-month follow-up, respectively

** Analyzed via ANOVA/ANCOVA tests. F statistics and P values are reported based on group source analysis

[a] Crude analysis

[b] Adjusted to baseline measurement of the variable (as covariance)

Table 4 Distribution of secondary outcomes according to two arms in addition to related effect sizes

MBSRQ Domain	Time point*	Intervention ($n=30$)		Control ($n=30$)		F (P value)**	MD [95% CI]	SMD [95% CI]	Partial eta^2
		Mean	SD	Mean	SD				
AE	Baseline	3.16	0.42	3.20	0.42	0.12(0.726)	-0.03[-0.25,0.18]	-0.09[-0.60,0.42]	0.002
	Postintervention [a]	3.47	0.37	3.15	0.37	11.32(0.001)	0.32[0.13,0.51]	0.87[0.34,1.40]	0.166
	Follow-up [a]	3.54	0.34	3.10	0.34	24.30(< 0.001)	0.44[0.26,0.61]	1.27[0.71,1.83]	0.299
AO	Baseline	3.29	0.36	3.62	0.36	12.43(0.001)	-0.33[-0.52, -0.14]	-0.91[-1.44, -0.37]	0.175
	Postintervention [a]	3.44	0.27	3.48	0.27	0.23(0.632)	-0.04[-0.18,0.11]	-0.13[-0.64,0.38]	0.004
	Follow-up [a]	3.56	0.30	3.45	0.30	1.76(0.190)	0.11[-0.05,0.27]	0.36[-0.15,0.87]	0.30
FE	Baseline	3.31	0.47	3.23	0.47	0.41(0.522)	0.08[-0.16,0.32]	0.17[-0.34,0.67]	0.007
	Postintervention [a]	3.29	0.45	3.22	0.45	0.29(0.591)	0.06[-0.17,0.29]	0.14[-0.37,0.64]	0.005
	Follow-up [a]	3.32	0.39	3.34	0.39	0.03(0.860)	-0.02[-0.22,0.18]	-0.5[-0.55,0.46]	0.001
FO	Baseline	3.31	0.35	3.25	0.35	0.45(0.504)	0.06[-0.12,0.24]	0.17[-0.33,0.68]	0.008
	Postintervention [a]	3.33	0.28	3.27	0.28	0.69(0.409)	0.06[-0.09,0.21]	0.22[-0.29,0.72]	0.012
	Follow-up [a]	3.38	0.33	3.22	0.33	3.63(0.062)	0.16[-0.01,0.34]	0.49[-0.02,1]	0.060

AE: appearance evaluation; AO: appearance orientation; FE: fitness evaluation; FO: fitness orientation; MD: mean difference; CI: confidence interval; SMD: standardized mean difference (based on Cohen's d test); ANOVA: analysis of variance; ANCOVA: analysis of covariance

*Expressed as the mean ± standard deviation. The baseline, postintervention and follow-up values represent the results of the participants' assessments before and after the intervention and at the one-month follow-up, respectively

** Analyzed via ANOVA/ANCOVA tests. F statistics and P values are reported based on group source analysis

[a] Adjusted to baseline measurement of the variable (as covariance)

Table 5 Distribution of secondary outcomes according to two arms in addition to related effect sizes

MBSRQ Domain	Time point*	Intervention ($n=30$)		Control ($n=30$)		F (P value)**	MD [95% CI]	SMD [95% CI]	Partial eta^2
		Mean	SD	Mean	SD				
HE	Baseline	2.99	0.50	3.27	0.50	4.72(0.034)	-0.28[-0.53, -0.02]	-0.56[-1.07, -0.04]	0.075
	Postintervention [a]	2.92	0.35	3.18	0.35	7.76(0.007)	-0.26[-0.44, -0.07]	-0.73[-1.25, -0.21]	0.120
	Follow-up [a]	3.01	0.42	3.23	0.42	3.85(0.055)	-0.22[-0.44,0.00]	-0.52[-1.03,0.00]	0.063
HO	Baseline	3.29	0.53	3.41	0.53	0.77(0.385)	-0.12[-0.40,0.15]	-0.23[-0.73,0.28]	0.013
	Postintervention [a]	3.52	0.37	3.25	0.37	7.75(0.007)	0.27[0.07,0.46]	0.72[0.20,1.24]	0.120
	Follow-up [a]	3.57	0.34	3.26	0.34	12.70(0.001)	0.31[0.14,0.48]	0.92[0.39,1.45]	0.182
IO	Baseline	2.97	0.54	2.93	0.54	0.06(0.811)	0.03[-0.24,0.31]	0.06[-0.44,0.57]	0.001
	Postintervention [a]	2.96	0.40	2.97	0.40	0.00(0.966)	-0.00(-0.21,0.20)	-0.01[-0.52,0.49]	0.000
	Follow-up [a]	3.02	0.43	2.96	0.43	0.29(0.595)	0.06[-0.16,0.28]	0.14[-0.37,0.64]	0.005
BASS	Baseline	3.21	0.87	3.14	0.87	0.08(0.780)	0.06[-0.39,0.51]	0.07[-0.43,0.58]	0.001
	Postintervention [a]	3.99	0.51	3.10	0.51	45.03(< 0.001)	0.88[0.62,1.15]	1.73[1.13,2.32]	0.441
	Follow-up [a]	4.03	0.51	3.09	0.51	50.92(< 0.001)	0.95[0.68,1.21]	1.84[1.23,2.44]	0.472

HE: Health evaluation; HO: Health orientation; IO: Illness orientation; BASS: Body areas satisfaction; MD: Mean difference; CI: Confidence interval; SMD: Standardized mean difference (based on Cohen's d test); ANOVA: Analysis of variance; ANCOVA: Analysis of covariance

*Expressed as the mean ± standard deviation. The baseline, postintervention and follow-up values represent the results of the participants' assessments before and after the intervention and at the one-month follow-up, respectively

** Analyzed via ANOVA/ANCOVA tests. F statistics and P values are reported based on group source analysis

[a] Adjusted to baseline measurement of the variable (as covariance)

Similarly, the decrease in health evaluation scores warrants further investigation to determine whether this reflects a temporary heightened awareness of health issues that participants aimed to address following the intervention.

According to the literature, few comprehensive studies have examined the impact of the MBAT on BI, encompassing various sample groups, including those with PCOS and other populations, especially those with quantitative designs. Nevertheless, in 2017, Buck conducted a qualitative study [41] that combined mindfulness and art therapy to enhance students' understanding of BI factors and promote self-compassion. The study's key findings included heightened awareness and acceptance through mindfulness and features related to art therapy, such as normalization, vulnerability, and the distinct concept of tangibility. Focus-oriented art therapy involves using art to enhance somatic awareness and connect with inner bodily sensations, promoting a deeper mind-body connection for resolving distressing experiences [42].

Table 6 Distribution of secondary outcomes according to two arms in addition to related effect sizes

MBSRQ Domain	Time point	Intervention ($n=30$)		Control ($n=30$)		F (P value)	MD [95% CI]	SMD [95% CI]	Partial eta^2
		Mean	SD	Mean	SD				
OP	Baseline	3.97	0.85	3.11	0.85	0.42(0.519)	-0.14[-0.58,0.30]	-0.17[-0.67,0.34]	0.007
	Postintervention	2.81	0.64	3.04	0.64	1.98(0.164)	-0.23[-0.56,0.10]	-0.36[-0.87,0.15]	0.034
	Follow-up	2.74	0.54	3.18	0.54	9.93(0.003)	-0.44[-0.72, -0.16]	-0.82[-1.34, -0.28]	0.148
SW	Baseline	3.08	0.94	3.63	0.94	5.16(0.027)	-0.55[-1.03, -0.07]	-0.59[-1.10, -0.07]	0.081
	Postintervention	3.57	0.49	3.38	0.49	2.42(0.126)	0.20[-0.06,0.46]	0.41[-0.10,0.92]	0.041
	Follow-up	3.62	0.49	3.42	0.49	2.36(0.130)	0.20[-0.06,0.46]	0.41[-0.11,0.91]	0.040

OP: overweight preoccupation; SW: self-classified weight; MD: mean difference; CI: confidence interval; SMD: standardized mean difference (based on Cohen's d test); ANOVA: analysis of variance; ANCOVA: analysis of covariance

*Expressed as the mean ± standard deviation. The baseline, postintervention and follow-up values represent the results of the participants' assessments before and after the intervention and at the one-month follow-up, respectively

** Analyzed via ANOVA/ANCOVA tests. F statistics and P values are reported based on group source analysis

[a] Adjusted to baseline measurement of the variable (as covariance)

The integration of MBSR principles into MBAT highlights the importance of mindfulness in shaping individuals' perceptions of their bodies. Mindfulness is associated with self-regulation, enabling individuals to confront uncomfortable experiences without impulsive reactions [43]. Engaging in mindfulness practices fosters mental stability; appreciation for each moment; and the cultivation of inner strength, patience, nonjudgmental awareness, self-acceptance, compassion, and flexibility [18]. In this context, mindfulness serves to counteract biased information processing related to BI dissatisfaction.

Chang et al. [44] reported a positive impact of online-delivered MBSR on BI in women with breast cancer [44]. In another study, Pintado and Andrade [14] found that, compared with a personal image advice program, a mindfulness-based intervention based on MBSR effectively enhanced emotional and psychological aspects related to BI in breast cancer patients [14].

Additionally, the inclusion of art therapy components within the MBAT provides a unique avenue for participants to express their thoughts and feelings related to BI through creative expression. Art therapy can help improve BI by helping individuals address both conscious and unconscious self-narratives and promoting mental and physical well-being through creative expression [45, 46]. It offers a means to resolve conflicts, enhance social skills, manage behavior, reduce stress, boost self-esteem, and gain valuable insights [46]. Engaging in artistic activities enables individuals to explore mind-body relationships and reshape their self-perceptions, fostering self-care and self-management [47], which contributes to more positive BI. Higenbottam's study [15] demonstrated the effectiveness of art therapy in addressing BI concerns among adolescent girls facing various challenges, including negative BI eating disorders and eating disorders.

The present study had several limitations, as follows. First, the intensity level of MBAT sessions may not be generalizable to other settings where patients with PCOS typically seek care (e.g., with their primary care or gynecologic providers). To address this concern, we propose conducting feasibility studies in more varied clinical settings. Second, the results of some MBSRQ domains, due to wide confidence intervals, remained inconclusive, possibly because of an inadequate sample size. Thus, further research with a larger sample size is highly recommended. Considering various potential factors beyond our control, such as social media [48], sociocultural factors [49, 50], family members' influences [51], COVID-19 and quarantine [52–54], and even noncomprehensive intervention session content, our intervention may not adequately address certain dimensions of the MBSRQ. Third, the control group did not receive any kind of intervention. In future studies, it might be helpful to provide them with general education classes to determine whether group support could influence the main results. Fourth, we had to move the intervention online because of COVID-19 restrictions. Although this is different from what is usually done, it actually has some benefits, such as making the program more accessible and reaching a wider audience.

Conclusion

In summary, our research contributes to the increasing body of evidence affirming the effectiveness of the MBAT in enhancing perceptions of BI, revealing a substantial and conclusive effect. The findings from this investigation endorse the potential of the MBAT as a viable intervention deserving further scrutiny in PCOS populations where individuals contend with BI dissatisfaction and aspire to enhance their positive BI.

By synergizing mindfulness and art therapy, the MBAT provides a comprehensive approach to address the multifaceted nature of BI concerns. We recommend that future researchers and clinicians consider a more targeted use of our MBAT session content to address the dimensions of the MBSRQ domains that exhibited deterioration or remained unchanged.

Abbreviations

MBAT	Mindfulness-Based Art Therapy
PCOS	Polycystic ovary syndrome
MBSR	Mindfulness-based stress reduction
BI	Body image
MBSRQ	Multidimensional Body-Self Relations Questionnaire
REBT	Rational-Emotional-Behavior Theory

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Author contributions
All authors contributed to the study conception and design. ZR: Investigation, Writing - Original Draft, Formal analysis, Visualization. AA: Conceptualization, Methodology, Supervision, Project administration, Visualization. FM: Conceptualization, Methodology, Project administration, Review & Editing, Visualization. MG: Formal analysis, Visualization. All the authors have approved the final version of the manuscript for submission.

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Data availability
The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This manuscript was derived from a master's thesis. The trial received approval from the Research Ethics Committees of Kerman University of Medical Sciences (Approval code: IR.KMU.REC.1398.485), and registration was completed on the Iranian clinical trial website (Registration code (25/01/2020): IRCT20170611034452N9). Written informed consent was obtained from all the subjects to enter the study, and the participants could easily withdraw from the study whenever they were willing. The study was conducted following the Declaration of Helsinki and Ethics Publication on Committee (COPE). Unique codes were used for each of the participants to ensure information confidentiality.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Nursing Research Center, Kerman University of Medical Sciences, Kerman, Iran
[2]Reproductive and Family Health Research Center, Kerman University of Medical Sciences, Kerman 7616913555, Iran

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