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# Effects of online mindful self-compassion intervention on negative body image in breast cancer patients: A randomized controlled trail

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ABSTRACT

*Purpose:* The incidence of breast cancer patients with negative body image has increased. However, research on interventions that explicitly reduce negative body image among breast cancer patients remains inadequate. The development of more pragmatic interventions is imperative. Therefore, we conducted this study to assess the effectiveness of a 6-week online Mindful Self-Compassion (MSC) intervention to reduce the negative body image in breast cancer patients.

*Methods:* We randomly assigned 64 female breast cancer patients to either the MSC group or the control group. The MSC group received a 6-week online Mindful Self-Compassion intervention, while the control group received no psychological training. Participants were surveyed by the Self-Compassion Scale-Short Form (SCS-SF), the Self-Acceptance Questionnaire (SAQ), the Chinese Perceived Stress Scale (CPSS), and the Body Image Scale (BIS) at baseline (T1), post-intervention (T2), and 1-month follow-up (T3).

*Results:* All outcome variables demonstrated significant time main effects and nonsignificant group main effects. The MSC and control groups had significant time × group interaction effects on self-compassion, self-acceptance, perceived stress, and negative body image. Simple main effects analysis revealed significant improvements in outcome variables at three-time points for the MSC group.

*Conclusion:* A 6-week online Mindful Self-Compassion intervention can improve self-compassion and self-acceptance and reduce perceived stress and negative body image among the breast cancer patients in MSC group. Mindful Self-Compassion intervention shows promise as a viable way to maintain the mental well-being of breast cancer patients.

## 1. Introduction

Breast cancer is by far the most prevalent form of malignancy worldwide. It is expected that there will be 3 million new breast cancer cases annually by 2040; thus, the disease is a significant global public health burden (Arnold et al., 2022). The incidence of breast cancer has also increased in China(Xia et al., 2022), leading to an increased number of patients experiencing negative body image post-diagnosis (Liu et al., 2022). Breast cancer is known to cause lasting physical and psychological pain to women, and they experience "tangible and intangible changes" in their bodies. Tangible changes include temporary or sometimes permanent hair loss, skin retraction, scarring, and breast asymmetry. There are also many intangible changes, such as cessation of menstruation, numbness, chronic pain, metabolic changes, fatigue, sexual dysfunction, and sleep difficulties (Brunet et al., 2013). These changes evoke long-term body image problems in women (Lewis-Smith et al., 2018).

Negative body image is a multidimensional structure that includes cognitive aspects (negative evaluations, and beliefs related to appearance), emotional aspects (negative emotions about the body), and behavioral aspects (avoiding crowds because of appearance) (Kling et al., 2019). Previous studies have found that 31%–83% of breast cancer patients experienced body image problems (El Kherchi et al., 2020; Fiser et al., 2021). Negative body image has consistently been shown to be associated with increased mental distress and impaired quality of life (Esplen et al., 2020) as it exacerbates anxiety and

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depression and can bring about mental health deterioration (El Kherchi et al., 2020). Educational groups and support groups have been reported to address body image problems in breast cancer survivors (Trachtenberg et al., 2020). However, in general, the number of available studies that address negative body image in breast cancer patients is sparse. The negative body image in breast cancer patients has not been sufficiently explored, and there is a pressing need for more empirical studies of psychological interventions to assess the effectiveness of additional interventions (Sebri et al., 2021).

Self-compassion has been proven to protect against cancer-related negative body image (Przezdziecki et al., 2016). It comprises three core elements: self-kindness (understanding one's flaws and failures and being kind to oneself), common humanity (suffering is part of everyone's life), and mindfulness (maintaining clear and balanced awareness and avoiding overidentification) (Germer and Neff, 2013). All three components may contribute to reduce negative body image in breast cancer patients. Such as being kind to oneself rather than judging one's body harshly, accepting the imperfections, and understanding the body's pain and changes with clarity and balanced awareness (Seekis et al., 2020). Self-compassion predicts acceptance of faults in oneself and others, and self-compassionate individuals report greater acceptance of their flaws (Zhang et al., 2020). Enhancing self-compassion in breast cancer patients may help to improve subjective well-being self--acceptance, and respect for the body (Brunet et al., 2013). Self-compassion also decreases perceived stress and internalizing symptoms(Lathren et al., 2019). Thus, self-compassion may mitigate negative body image by decreasing an individual's perceived stress and enhancing self-acceptance.

Germer and Neff developed the 8-week Mindful Self-Compassion (MSC) program (2.5 h of classes per week plus a half-day retreat) (Germer and Neff, 2013). Designed to cultivate effective self-care strategies and enhance mindfulness as the foundation for self-compassion, the program incorporates formal practices (e.g., self-compassion breathing, giving and receiving compassion), meditations (e.g., compassionate meditation), and informal practices (e.g., a self-compassion diary) for daily life(Neff, 2022). Traditional MSC interventions have been shown to enhance resilience and to reduce negative experiences such as pain, stress, depression, and anxiety (Torrijos-Zarcero et al., 2021).

With the advent of the internet, online interventions have shown many advantages. These interventions are more convenient and economical than offline group interventions, can traverse spatial distances, and are not complicated by challenges such as patients' ability to travel for activities (Li et al., 2021). In the COVID-19 era, online interventions could reduce the risk of individuals becoming infected during an outbreak (Guan et al., 2021).

Previous studies have shown the potential of online MSC, but many were carried out in multiple cancer types, and some lack control groups. Therefore, we conducted an online MSC intervention study and hypothesized that this intervention might improve self-acceptance and reduce negative body image in breast cancer patients.

## 2. Methods

### 2.1. Participants

The sample size of this study was obtained using G*power3.1 software. Under repeated measures (within-between interaction) ANOVA, Power was taken as 0.95, the number of groups as 2, and the number of measurements as 3. The minimum sample size was 44 at Effect size f = 0.25.

Inclusion criteria include women aged 18–65, diagnosed breast cancer (stage 0-IV), and no training related to MSC. Exclusion criteria include a history of psychiatric disorders, and comorbidity with other primary medical conditions.

We recruited breast cancer patients through recruitment advertisements from September to October 2022 at Southwest Hospital. Before enrollment, each participant was screened by telephone to determine eligibility, and the researchers explained the intervention setting and requirements. All participants signed an electronic version of the informed consent form.

A total of 66 breast cancer patients were recruited for this study, of whom two withdrew before the intervention and seven did not complete all measurements. The final sample comprised 57 female participants aged 23–59. This study used a random number table method for random grouping. A random number from 1 to 64 was generated in Excel for each patient participating in the study, with 1–32 being the intervention group and 33–64 being the control group. Participants were randomly assigned to either the intervention or control group. The intervention group received 6 weeks of MSC training. The control group entered the waiting list and received no psychological training (Fig. 1 displays the participants' flow chart.).

We randomly assigned 64 breast cancer patients to either the MSC group or the control group at T1. Follow-up was performed after the intervention (T2) and 1 month after the intervention (T3). Finally, a total of 29 patients in the MSC group completed all follow-up visits, and 28 patients in the control group eventually completed all follow-up visits.

### 2.2. Procedure

All subjects gave their informed consent and volunteered to participate in the study. They completed the online demographic and outcome variable scales through the online survey platform Sojump to assess their self-compassion, self-acceptance, perceived stress, and negative body image. The same surveys were administered at 3-time points pre-intervention (T1), post-intervention (T2), and 1-month follow-up(T3). This study was registered with the Chinese Clinical Trial Registry and received registration number ChiCTR–OOC–17012132(July 25, 2017). This study has also been reviewed by the Medical Ethics Committee of Southwest Hospital and received an ethical approval number (PLA (A) KY2022101). Human subjects' rights to privacy were always respected. All participants signed an electronic version of the informed consent form. The Medical Scientific Research of Chongqing Science and Health Joint Project funded the research for this publication (No.2020FYYX027).

### 2.3. Intervention

Based on the standard 8-week MSC program of Neff & Germer et al. (Germer and Neff, 2013). The standard MSC program is co-led by two clinical psychologists with longstanding personal practices in positive meditation and extensive professional experience in mindfulness and acceptance-based psychotherapy. MSC focuses on a specific weekly topic (Germer and Neff, 2013). Week 1 provides a general introduction and review of self-compassion. Week 2 provides the basics of mindfulness. Week 3 discusses the application of self-compassion in all aspects of life. Week 4 helps participants develop a caring inner voice. Week 5 emphasizes the importance of living following core values. Week 6 teaches techniques for dealing with difficult emotions. Week 7 Dealing with challenging interpersonal relationships. Week 8 connects with life's positive aspects with an appreciative attitude. There is also a half-day retreat between weeks 4 and 5 for 4 h in silence while performing various meditations, restorative yoga, and joyous eating(Neff and Germer, 2013).

The MSC program for this study was adapted as a 6-week course. The exercises in it were the same as in the standard 8-week MSC program. The specific MSC intervention program is shown in Table 1. Previous studies have found that a 6-week MSC can significantly improve self-compassion and lead to a range of positive outcomes(Gaiswinkler et al., 2020). Thus, the final program was a 90-min group-based online meeting that occurred once a week for 6 weeks. To ensure fidelity, we

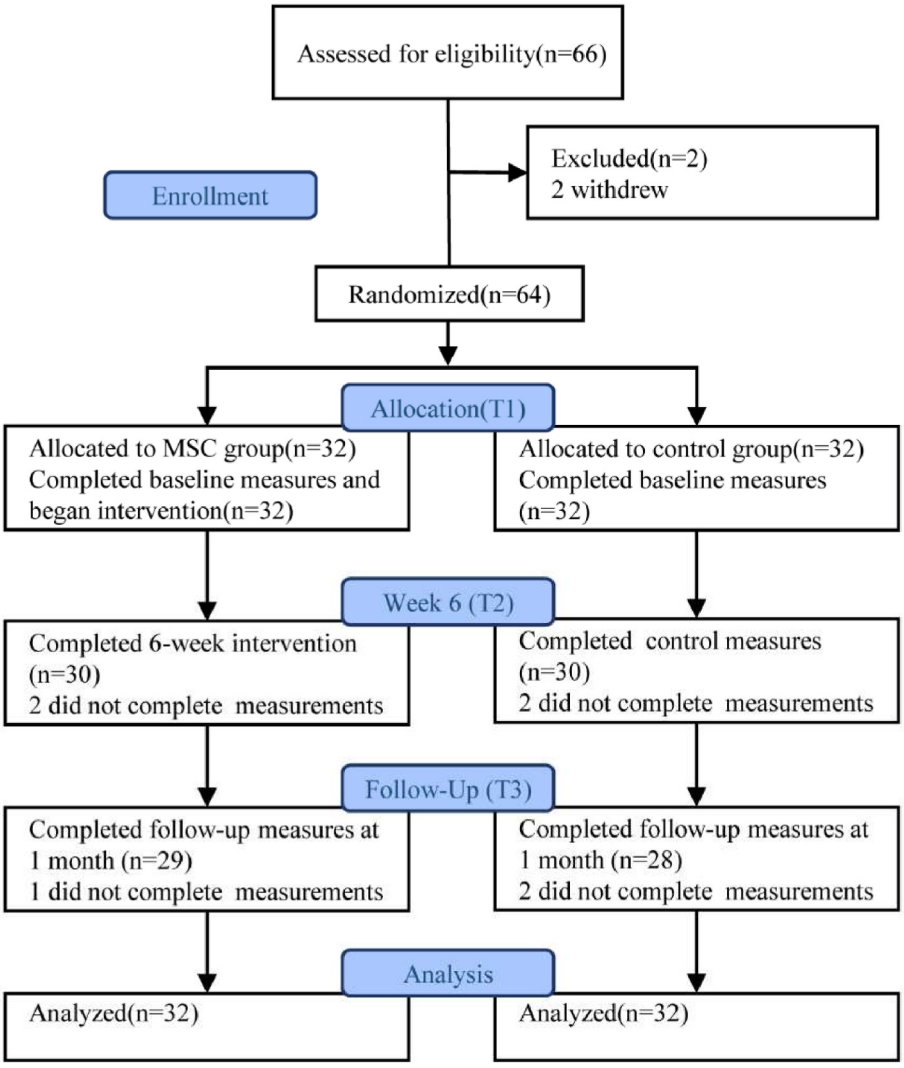


**Fig. 1.** Participant flow chart.

asked participants to show their faces with the video the entire time. Each session was completed on the Tencent Meetings software, with all intervention group participants meeting online simultaneously.

The group was led by a professor of clinical psychology and facilitated by a graduate student in psychology. The professor has extensive professional experience in mindfulness and MSC. Participants in the intervention group completed the 6-week online session. The researcher also sent the audio of all the exercises to the group members and encouraged the participants to practice them daily to bring self-compassion into their lives.

### 2.4. Outcome measures

Demographic variables include age, marital status, education level, employment status, diagnosis time, cancer stages, treatment method, and whether to complete radiotherapy and chemotherapy or not.

#### 2.4.1. The Self-Compassion Scale-Short Form (SCS-SF)

The SCS-SF has 12 items and is a shortened version of the 26-item self-compassion scale (Raes et al., 2011). Despite the reduced number of entries, the SCS-SF is reliable and has the same factor structure as the original scale. It has a high internal consistency and has been used in Chinese women(Meng et al., 2020). The scale uses a 5-point scale ranging from 1 (almost always not) to 5 (almost always). The higher the score, the higher the self-compassion. The Cronbach coefficient for this study was 0.822.

#### 2.4.2. The Self-Acceptance Questionnaire (SAQ)

The SAQ has 16 items and was developed by Cong & Gao (Cong and Gao, 1999). The SAQ consists of two subscales(self-acceptance, and self-evaluation). This study used the total score of the self-acceptance and self-evaluation dimensions. The self-acceptance dimension is scored on a scale of 1–4. As in item 6, “Overall, I am delighted with myself.” 1 means very nonconforming, and 4 means very conforming. In contrast, the self-evaluation dimension was reverse-scored. The total score ranges from 16 to 64, with higher scores indicating higher levels of self-acceptance. The SAQ has been used in Chinese women with breast cancer(Chen et al., 2017). The Cronbach coefficient for this study was 0.789.

#### 2.4.3. The Chinese Perceived Stress Scale (CPSS)

The CPSS has 14 items, which include 7 forward items and 7 reverse entries (Yang and Huang, 2003). The scale is graded on a range of 1–5, with 1 (being "never") and 5 (being "always"). The total grade is the sum of the item scores. The higher the score, the higher the perceived stress. The Cronbach coefficient for this study was 0.787.

**Table 1**
6-week Mindful Self-Compassion intervention program design.

| Time | Topics | Contents |
|---|---|---|
| Week 1 | Discovering mindful self-compassion | Overview of self-compassion, the benefits and physiological mechanisms of self-compassion. Practice "Relaxation Touch," "Instant Self-Compassion," and "Self-Compassion Movement." |
| Week 2 | Managing difficult emotions | Naming emotions, being aware of feelings in the body, relaxing - soothing - allowing. Practice "Handling Difficult Emotions" and "Give Yourself Compassion." |
| Week 3 | Finding your compassionate voice | Thoughts are not facts. Become aware of harmful core beliefs. Practice "Dealing with Negative Core Beliefs" and "Finding Your Compassionate Voice." |
| Week 4 | Embracing the body with self-compassion | Connecting with the body, embracing your body with self-compassion, and coping with rekindling. Practice "the Self-Compassion Body Scan" and "Foot Meditation." |
| Week 5 | Transforming relationships | Be there for others but don't lose yourself and cope with caregiver burnout. Practice "Caring Friends with Heart," "Giving and Receiving Self-Compassion," and "Calm Compassion." |
| Week 6 | Embracing your life | Appreciating myself and the excitement of life, what do I want to remember? Practice "Self-Appreciation" and "Tasting the Moment." |

#### 2.4.4. The Body Image Scale (BIS)

The BIS is a 10-item scale developed specifically for cancer patients (Hopwood et al., 2001). The scale uses a four-point scale of (0 not at all - 3 very much) with a total score range of 0–30. The higher the score, the higher the negative body image. BIS has been used in Chinese breast cancer patients and has good reliability (Cai et al., 2021). The Cronbach coefficient for this study was 0.859.

### 2.5. Statistical analysis

Data were analyzed by R 4.3.1. Data analysis for this study followed the principles of intention-to-treat (ITT) analysis. We multiply interpolated the missing data (See Fig. 2). Differences in participants' demographic characteristics were compared using chi-square tests. Baseline self-compassion, self-acceptance, perceived stress, and negative body image were compared between the intervention and control groups using independent sample t-tests. A repeated measures ANOVA was conducted for data from the intervention and control groups before (T1), after (T2), and one month after (T3) the intervention. The significance level was set at 0.05. The effects are reported as partial eta squared($\eta_p^2$). This study uses $\eta_p^2$ to determine effect size. Below 0.13 is a small effect, 0.13–0.25 is a medium effect, and above 0.27 is a large effect (Bakeman, 2005).

## 3. Results

### 3.1. Demographics and baseline information of participants

There was no significant difference in demographic data between the MSC and control groups. The two groups were consistent at baseline (Table 2).

### 3.2. Effect of MSC on all outcome variables

At baseline T1, the two groups had no significant differences in self-compassion ($t$ = 0.038, $P$ = 0.970), self-acceptance ($t$ = 0.307, $P$ = 0.760), perceived stress ($t$ = 0.565, $P$ = 0.574), and negative body image ($t$ = 0.461, $P$ = 0.647) (See Fig. 3).

Analysis of self-compassion revealed a significant time main effect and a significant time × group interaction [$F$ (2,61) = 4.535, $P$ = 0.018, $\eta_p^2$ = 0.068]. Simple main effects analysis revealed significant differences in the MSC group's self-compassion T1 versus T2 and T1 versus T3 ($P$ < 0.01). In contrast, the control group has no significant differences at all three-time points. At T2 and T3, the two groups significantly differed in self-compassion ($P$ < 0.05) (See Table 3, Table 4, and Fig. 4).

Analysis of self-acceptance revealed a significant time main effect and a significant time × group interaction [$F$ (2,61) = 4.354, $P$ = 0.019, $\eta_p^2$ = 0.066]. Simple main effects analysis revealed that self-acceptance in the MSC group was significantly different at T1 versus T2 and T1 versus T3($P$ < 0.01). In contrast, self-acceptance in the control group was not significantly different at all three-time points. At T2 and T3, the two groups had a significant difference in self-acceptance ($P$ < 0.05).

Analysis of perceived stress revealed a significant time main effect and a significant time × group interaction [$F$ (2, 61) = 7.037, $P$ = 0.002, $\eta_p^2$ = 0.102]. Simple main effects analysis revealed significant differences at T1 versus T2 and T1 versus T3 in the MSC group ($P$ < 0.01). In contrast, there was no significant difference in perceived stress in the

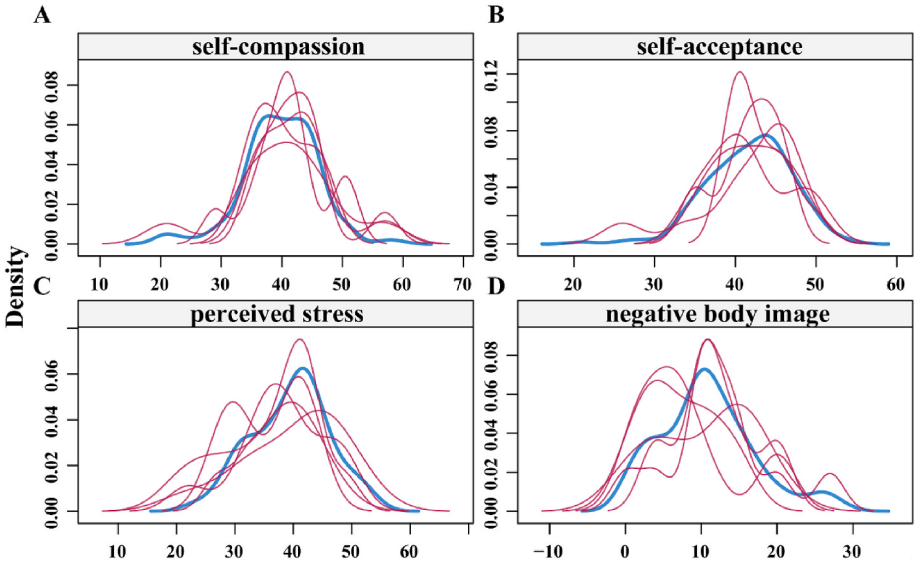


**Fig. 2.** Density after multiple interpolations A. Density of self-compassion after multiple interpolations. B. Density of self-acceptance after multiple interpolations. C. Density of perceived stress after multiple interpolations. D. Density of negative body image after multiple interpolations.

**Table 2**
Demographic results of the participants [n (%)].

| | MSC group ( n = 32 ) | Control group(n = 32) | $\chi^2$ | *P* |
|---|---|---|---|---|
| Age | | | | |
| age < 30 | 1(3.12) | 1(3.12) | 2.046 | 0.679 |
| 30≤age < 40 | 6(18.75) | 8(25) | | |
| 40≤age < 50 | 13(40.63) | 8(25) | | |
| age≥50 | 12(37.5) | 15(46.88) | | |
| Marital status | | | | |
| unmarried | 1(3.12) | 1(3.12) | 0.525 | 1.000 |
| married | 29(90.63) | 28(87.5) | | |
| divorced | 2(6.25) | 3(9.38) | | |
| Education level | | | | |
| primary school | 0 | 2(6.25) | 6.288 | 0.155 |
| middle school | 7(21.88) | 14(43.75) | | |
| high school | 7(21.88) | 6(18.75) | | |
| specialized | 10(31.25) | 6(18.75) | | |
| university and above | 8(25) | 4(12.5) | | |
| Employment status | | | | |
| work | 21(65.63) | 15(46.88) | 2.547 | 0.302 |
| unemployed | 6(18.75) | 11(34.37) | | |
| retired | 5(15.62) | 6(18.75) | | |
| Diagnosis time | | | | |
| ≤2years | 26(81.25) | 31(96.88) | 3.858 | 0.104 |
| 2–5years | 5(15.63) | 1(3.12) | | |
| ≥5years | 1(3.12) | 0 | | |
| Cancer stages | | | | |
| stage0 | 1(3.12) | 1(3.12) | 1.649 | 0.863 |
| stageI | 9(28.13) | 6(18.75) | | |
| stageII | 8(25) | 10(31.25) | | |
| stageIII | 11(34.37) | 10(31.25) | | |
| stageIV | 3(9.38) | 5(15.63) | | |
| Type of surgery | | | | |
| breast-conserving surgery | 12(37.5) | 10(31.25) | 0.649 | 0.766 |
| mastectomy | 16(50) | 19(59.37) | | |
| breast reconstruction | 4(12.5) | 3(9.38) | | |
| Completed radiotherapyand chemotherapy | | | | |
| >2 months | 26(81.25) | 21(65.62) | 2.080 | 0.345 |
| <2 months | 2(6.25) | 3(9.38) | | |
| incomplete | 4(12.5) | 8(25) | | |

control group at all three time points. At T3, the two groups had a significant difference in perceived stress($P < 0.05$).

Analysis of negative body image revealed a significant time main effect and a significant time × group interaction [$F\,(2, 61) = 4.060$, $P = 0.020$, $\eta_p^2 = 0.061$]. Simple main effects analysis revealed significant differences in negative body image between the MSC group at T1 versus T2 and T1 versus T3 ($P < 0.01$). In contrast, negative body image in the control group was not significantly different at any of the three time points. There was no significant difference between the two groups in body image at all time points between the groups.

### 3.3. Sensitivity analysis

We analyzed the full analysis set and found similar results to the ITT analysis. The full analysis set included 29 participants in the MSC group and 28 in the control group (See Table 5).

## 4. Discussion

This study assessed the effects of a 6-weeks online MSC intervention on psychological outcome variables such as negative body image in breast cancer patients. The results showed that the 6-week online MSC intervention significantly improved self-compassion and self-acceptance and reduced perceived stress and negative body image in the intervention group of breast cancer patients.

There are few available studies of MSC interventions in cancer patients. Brooker et al. investigated the efficacy of a face-to-face MSC program in a diverse population of adult cancer survivors (Brooker et al., 2020). A mixed-sex sample of 27 individuals completed an 8-week MSC intervention (105 min per week, omitting the 4-h retreat of standard MSC). The intervention had a minor and insignificant impact on body image. Concerns about body image may be less prominent in the mixed-sex samples than in the female samples. The study lacked a control group, and improvements in outcome variables before and after the intervention could not be attributed solely to the MSC program. The MSC intervention helped young cancer survivors manage psychosocial challenges, significantly improving anxiety, depression, social isolation, and body image problems, and facilitated post-traumatic growth (Campo et al., 2017). Although previous studies have not yielded consistent results, these improvements in psychosocial outcomes in cancer populations are encouraging. More convincing trials are needed to assess online MSC intervention's effectiveness further.

In our study, we adapted the protocol from an 8-week offline intervention to a 6-week online format, which significantly improved self-compassion despite modifications in duration, content, and delivery. Furthermore, there was a significant difference between the two groups at T2.

Self-acceptance was significantly improved in the intervention group. Self-compassion helps promote self-acceptance in women by reducing criticism of themselves and realizing that everyone experiences failure and imperfection. Thus, self-compassion may lessen the fear of negative self-evaluation and evaluation of others, increasing self-acceptance (Seekis et al., 2020) and accepting one's faults. Self-acceptance is one of the dimensions of psychological well-being. Some researchers have used network analysis to find that self-acceptance is essential to psychological well-being and significantly impacts other dimensions (Blasco-Belled and Alsinet, 2022). MSC intervention may also improve the psychological well-being of breast cancer patients.

Perceived stress was significantly reduced in the intervention group. Breast cancer patients may feel uncomfortable and stressed in public because they experience tangible changes in their appearance and fear curious glances from others (Uyar et al., 2022). Elevated levels of self-compassion can help manage these stresses effectively (Dev et al., 2020). Our results did not find a difference between the two groups because the widespread lockdown and quarantine measures during the epidemic, which imposed additional stress on participants.

Negative body image was significantly improved in the intervention group. Each of the three self-compassion components may help reduce negative body image. Mindfulness allows individuals to live with their bodies in a more balanced way, avoiding overidentification with perceived body defects and thus reducing negative body image. Common humanity encourages individuals to see that they are not the only ones who feel poorly about their body image and empowers a sense of connection with others. Self-kindness allows individuals to be more aware of their body and related thoughts and feelings and to support, understand, and hold themselves when faced with a lack of bodily integrity and illness that causes one to lose one's former shape. (Papini et al., 2022). However, we did not find a difference between the two groups, probably because some of the participants we recruited were still in treatments such as chemotherapy and radiotherapy. The effects of these treatments on negative body image could not be excluded. At the same time, the epidemic brought about a blockade, and patients could not get to the hospital on time for treatment and medical check-ups. Compensatory behaviors of repeated body check-ups may arise, increasing negative emotions.

Notably, although significant time × grouping interactions were identified in this study, the effect sizes were modest. This could be attributed to the limitations of online interventions, such as restricted face-to-face communication, discussion, and bonding among group members. However, our study demonstrates the effectiveness of online interventions and their advantages, such as ease of access and lack of spatial constraints (Eriksson et al., 2018).

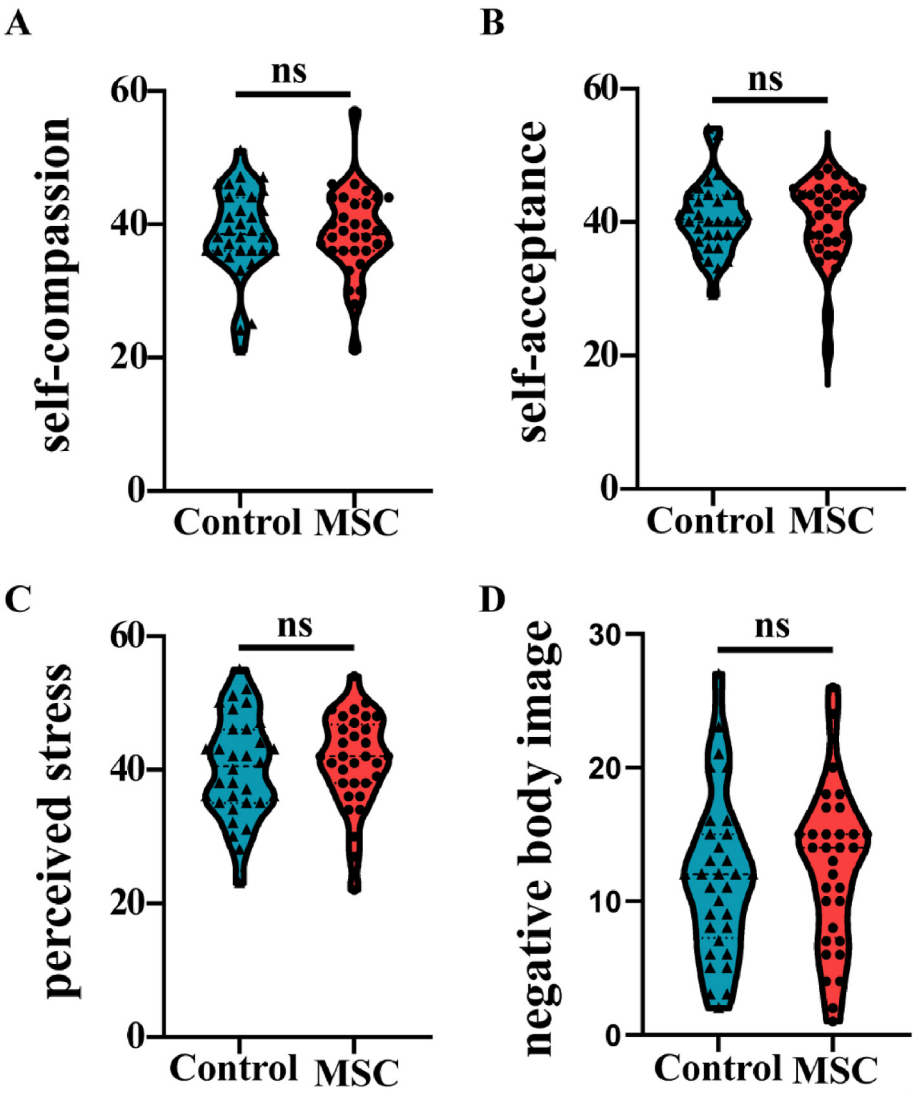


**Fig. 3.** Baseline comparison of outcome variables between the two groups. A. There was no significant difference in baseline self-compassion between the MSC and control groups (P > 0.05, ns) B. There was no significant difference in baseline self-acceptance between the MSC and control groups (P > 0.05, ns) C. There was no significant difference in baseline perceived stress between the MSC and control groups (P > 0.05, ns) D. There was no significant difference in baseline negative body image between the MSC and control groups (P > 0.05, ns).

**Table 3**
Comparison of outcome variables between the two groups at the three-time points.

| | | Group | | Groupmain effect | | Timemain effect | | | Time × Group interaction effect | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Time | MSC group(n = 32) | Control group(n = 32) | *F* | *P* | *F* | *P* | $\eta_p^2$ | *F* | *P* | $\eta_p^2$ |
| Self-compassion | T1 | 38.75 ± 6.51 | 38.69 ± 6.72 | 3.030 | 0.087 | 4.507 | 0.019[a] | 0.068 | 4.535 | 0.018[a] | 0.068 |
| | T2 | 42.38 ± 6.58 | 38.78 ± 5.42 | | | | | | | | |
| | T3 | 41.91 ± 6.20 | 38.53 ± 5.54 | | | | | | | | |
| Self-acceptance | T1 | 40.16 ± 6.07 | 40.59 ± 5.31 | 2.583 | 0.113 | 6.770 | 0.003[b] | 0.098 | 4.354 | 0.019[a] | 0.066 |
| | T2 | 43.59 ± 5.36 | 41.16 ± 4.24 | | | | | | | | |
| | T3 | 43.94 ± 3.98 | 40.88 ± 5.44 | | | | | | | | |
| Perceived stress | T1 | 41.28 ± 6.97 | 40.25 ± 7.61 | 1.383 | 0.244 | 6.294 | 0.004[b] | 0.092 | 7.037 | 0.002[b] | 0.102 |
| | T2 | 37.38 ± 6.50 | 39.94 ± 5.74 | | | | | | | | |
| | T3 | 36.97 ± 6.74 | 40.69 ± 6.42 | | | | | | | | |
| Negative body image | T1 | 12.44 ± 5.92 | 11.75 ± 6.02 | 0.727 | 0.397 | 6.199 | 0.003[b] | 0.091 | 4.060 | 0.020[a] | 0.061 |
| | T2 | 9.78 ± 5.92 | 11.41 ± 6.32 | | | | | | | | |
| | T3 | 8.69 ± 6.82 | 11.38 ± 6.86 | | | | | | | | |

[a] $P < 0.05$.
[b] $P < 0.01$.

**Table 4**
Paired comparison of outcome variables between the two groups.

| | Group | Time | *P* | Time | Group | *P* |
|---|---|---|---|---|---|---|
| Self-compassion | MSC | T1-T2 | 0.006[b] | T2 | MSC | 0.020[a] |
| | | T1-T3 | 0.001[b] | T3 | vs | 0.025[a] |
| | | T2-T3 | 0.920 | | Control | |
| | Control | T1-T2 | 1.000 | | | |
| | | T1-T3 | 0.996 | | | |
| | | T2-T3 | 0.986 | | | |
| Self-acceptance | MSC | T1-T2 | 0.001[b] | T2 | MSC | 0.048[a] |
| | | T1-T3 | 0.001[b] | T3 | vs | 0.013[a] |
| | | T2-T3 | 0.954 | | Control | |
| | Control | T1-T2 | 0.898 | | | |
| | | T1-T3 | 0.990 | | | |
| | | T2-T3 | 0.974 | | | |
| Perceived stress | MSC | T1-T2 | 0.001[b] | T2 | MSC | 0.100 |
| | | T1-T3 | < 0.001[c] | T3 | Vs | 0.027[a] |
| | | T2-T3 | 0.934 | | Control | |
| | Control | T1-T2 | 0.988 | | | |
| | | T1-T3 | 0.957 | | | |
| | | T2-T3 | 0.697 | | | |
| Negative body image | MSC | T1-T2 | 0.005[b] | T2 | MSC | 0.292 |
| | | T1-T3 | < 0.001[c] | T3 | vs | 0.121 |
| | | T2-T3 | 0.570 | | Control | |
| | Control | T1-T2 | 0.813 | | | |
| | | T1-T3 | 0.819 | | | |
| | | T2-T3 | 0.933 | | | |

[a] $P < 0.05$.
[b] $P < 0.01$.
[c] $P < 0.001$.

### 4.1. Limitations

First, this study was a single-center, small-sample study, thus, the representativeness of our study may be inadequate. Second, although we sent the audio of the exercises to each participant, this study did not quantify the duration and frequency of their home practice sessions. Third, there was participant attrition, but we did not obtain qualitative feedback on the feasibility and acceptability of this population. We only use one assessment control group and lack a positive control group. Moreover, online interventions may also present additional challenges like network failures and inadequate member discussions. The effectiveness of different forms of online MSC intervention versus offline intervention can be explored in the future. In addition, the measures in this study relied on self-reported scales and need to be combined with additional indicators to assess the effectiveness of the intervention. It also needs to be explored whether MSC intervention can improve objective indicators (such as cortisol, heart rate variability, brain network, and more). Researchers can explore more simple, feasible, and effective interventions to benefit more patients.

## 5. Conclusion

A 6-week online MSC intervention can improve self-compassion and self-acceptance and reduce perceived stress and negative body image in the MSC group of breast cancer patients. MSC intervention has the potential as a way to maintain the mental health of breast cancer patients.

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## CRediT authorship contribution statement

**Yanli Chen:** Writing – original draft, Formal analysis, Data curation. **Rongqian Liu:** Data curation. **Jia Xiao:** Investigation. **Yinhuan Wang:** Investigation. **Ying Yang:** Investigation. **Haiyan Fan:** Investigation. **Dan Li:** Investigation. **Chen Xu:** Writing – review & editing, Methodology, Data curation. **Xiaofan Yan:** Data curation. **Muyu Chen:** Data curation. **Li Peng:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Min Li:** Writing – review & editing, Supervision, Methodology, Conceptualization.

## Declaration of competing interest

The study's authors affirm that no financial or commercial

**Table 5**
Comparison of outcome variables between the two groups at the three-time points (Full Analysis Set).

| | | Group | | Group main effect | Time main effect | Time × Group interaction effect | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time | MSC group(n = 29) | Control group(n = 28) | *F* | *P* | *F* | *P* | *F* | *P* |
| **Self-compassion** | T1 | 38.10 ± 5.88 | 38.79 ± 7.13 | 1.489 | 0.228 | 6.984 | 0.004[b] | 5.747 | 0.010[a] |
| | T2 | 42.45 ± 6.81 | 38.93 ± 5.68 | | | | | | |
| | T3 | 41.45 ± 5.54 | 39.11 ± 4.77 | | | | | | |
| **Self-acceptance** | T1 | 39.76 ± 6.08 | 40.96 ± 5.45 | 1.260 | 0.266 | 7.784 | 0.001[b] | 5.998 | 0.005[b] |
| | T2 | 43.69 ± 5.57 | 41.36 ± 4.24 | | | | | | |
| | T3 | 43.83 ± 3.98 | 41.11 ± 4.91 | | | | | | |
| **Perceived stress** | T1 | 41.83 ± 6.31 | 40.07 ± 8.02 | 0.671 | 0.416 | 8.308 | 0.001[b] | 8.436 | 0.001[b] |
| | T2 | 37.17 ± 6.63 | 39.68 ± 5.74 | | | | | | |
| | T3 | 37.41 ± 6.20 | 40.57 ± 6.71 | | | | | | |
| **Negative body image** | T1 | 12.62 ± 6.00 | 11.25 ± 5.82 | 0.206 | 0.652 | 7.372 | 0.001[b] | 4.949 | 0.009[b] |
| | T2 | 9.93 ± 6.08 | 11.61 ± 6.17 | | | | | | |
| | T3 | 8.86 ± 6.97 | 10.64 ± 6.61 | | | | | | |

[a] $P < 0.05$.
[b] $P < 0.01$.

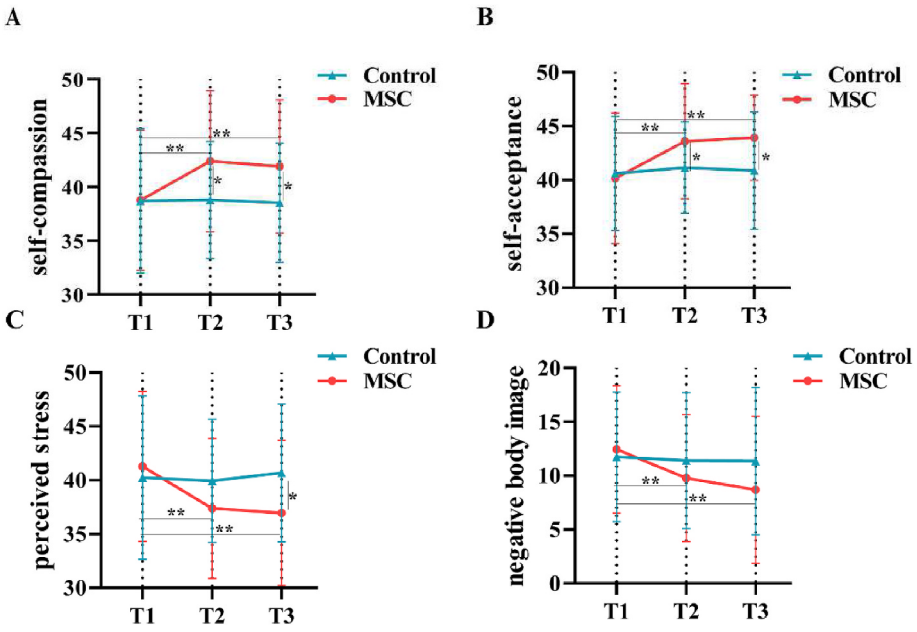


**Fig. 4.** Improvements in outcome variables at 3-time points for both groups. A. Self-compassion in the MSC and control groups at T1, T2, and T3 time points. B. Self-acceptance in the MSC and control groups at T1, T2, and T3 time points. C. Perceived stress in the MSC and control groups at T1, T2, and T3 time points. D. Negative body image in the MSC and control groups at T1, T2, and T3 time points.

relationships might be considered a potential conflict of interest.

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