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ORIGINAL ARTICLE

Mindful Self-Compassion for Infertility-Related Distress: A Single-Group Intervention Study

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Abstract

Objectives: Women experiencing infertility report heightened levels of anxiety, depression, and distress. However, access to affordable mental health care is limited in most areas of the world. Self-directed interventions, including bibliotherapy and mobile app-delivered interventions, provide a potentially cost-effective option for the treatment of infertility-related distress. This study assessed the efficacy of an 8-week self-directed mindful self-compassion intervention in reducing psychological distress and improving quality of life.

Methods: Fifty women experiencing infertility agreed to participate in a pre–post single-group intervention study. Fertility-related quality of life, anxiety, depression, mindfulness, self-compassion, and relationship satisfaction were assessed immediately after the intervention and again 1 month later.

Results: The intervention was well accepted. Only 5% dropped out of the program prematurely, and participants read an average of 18 out of 25 assigned book chapters. Expectancy and credibility scores were high, as were treatment satisfaction ratings. Reported levels of fertility-related quality of life ($d = 0.81$), mindfulness ($d = 0.79$), and self-compassion ($d = 0.84$) all increased, while levels of anxiety ($d = 0.64$) and depression ($d = 0.69$) significantly declined following the intervention. These changes were maintained at the 1-month follow-up. Compassion for others and relationship satisfaction were high at baseline and did not change following completion of the intervention.

Conclusion: This 8-week self-directed mindfulness self-compassion intervention appears to be a promising treatment for emotional distress related to infertility.

Keywords: infertility, mindfulness, self-compassion, self-help, depression, anxiety, fertility quality of life

Infertility affects one in six reproductive-aged couples, typically defined as an impairment of a person's capacity to reproduce or failure to achieve a successful pregnancy after 12 months or more of regular, unprotected sexual intercourse.[1] Infertility is associated with high levels of depression, anxiety, and distress, particularly among the intended gestational partner.[2,3] Although numerous psychotherapy approaches aimed at treating infertility-related distress have been developed, a recent meta-analysis of 58 randomized controlled trials concluded that currently available psychological interventions targeting infertility-related distress are only minimally effective.[4] Of the studies identified, nine explored mindfulness-based interventions adapted for infertility such as mindfulness-based stress reduction and mindfulness-based cognitive therapy. However, it was found that only trials conducted within the Middle East were associated with large effect sizes. In all other regions, psychotherapy for infertility was associated with small effect sizes, including mindfulness-based approaches.

There is therefore a need to identify new psychological approaches to treating infertility-related distress. One approach that may be promising is mindful self-compassion (MSC). MSC is a newer practice of mindfulness that explicitly focuses on self-compassion as the core component and guiding theoretical model.[5,6] MSC fosters and strengthens loving kindness toward oneself; it is about accepting things just as they are while making space for one's feelings about their situation. It is grounded by three main principles: self-kindness, a sense of common humanity, and mindfulness. MSC has been shown to be effective in treating depression and anxiety as well as improving quality of life in those suffering from chronic pain and other chronic health concerns.[7]

Infertility is associated with many emotional challenges that may be particularly well addressed by MSC. For example, a recent qualitative study interviewing women with infertility as well as mental health providers specializing in infertility identified shame and self-blame, two prime targets

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of MSC, as key factors contributing to infertility-related distress.[8] Furthermore, in 1 study of 172 women with infertility, levels of self-compassion were negatively correlated with levels of infertility-related distress,[9] suggesting that self-compassion may increase resilience in the face of infertility. Self-compassion was also negatively correlated with interpersonal relationship concerns,[9,10] another factor that has been found to be a key component of infertility-related distress.[8] These findings suggest that MSC may be particularly beneficial for women experiencing infertility. The current study therefore aimed to pilot test an MSC approach to improving infertility-related distress.

In addition to comparing the effectiveness of different psychotherapy approaches, the meta-analysis of psychotherapy interventions for infertility described above[4] also compared the effectiveness of different psychotherapy formats, including individual therapy, group therapy, and self-help formats. No differences in effectiveness were found across the various therapy formats. Thus, in considering what format an MSC intervention for infertility should take, we reasoned that a self-guided intervention would be most cost-effective and most accessible. Indeed, there is a significant lack of access to mental health services,[11] and self-directed or self-guided interventions may play an important role in addressing the current gap in mental health care and improving accessibility.[12] This may be particularly important in the context of infertility given the lack of mental health professionals who are experienced in providing care to individuals with infertility. Furthermore, a robust body of literature supports the efficacy of app-based mental health care and bibliotherapy.[13–15] The feasibility of a self-guided self-compassion intervention is demonstrated by a trial by Krieger et al. exploring this mode of intervention for a sample of highly self-critical adults. Completion rates were high, and participants' self-compassion significantly improved following the 7-week self-administered self-compassion intervention.[16]

The current study aimed to test the feasibility and acceptability of a self-directed MSC intervention for infertility-related distress. Specifically, the intervention involved reading a published self-help book on MSC over the course of 8 weeks as well as engaging in daily meditation using a publicly available mobile phone application created by the Center for Mindfulness Studies, a mental health charity in Canada. Treatment feasibility was assessed via a number of indicators, including participant ratings of treatment credibility and expected benefit, participant satisfaction, participant completion and retention, decreases in depression, anxiety and relationship dissatisfaction, and increases in fertility quality of life.

Method

Overview

The protocol for this pre–post single-group intervention study registered with clinicaltrials.org (NCT05183568). This article was prepared in accordance with the STROBE and TREND reporting guidelines.

Participants

Participants had to be literate, be of reproductive age (18–45 years old), be actively attempting to become pregnant, and be living in Canada. Participants were recruited through Facebook, Twitter, Instagram, and Reddit. Eligibility criteria included the following: inability to conceive despite a period of at least 12 months of heterosexual intercourse and/or pursuing fertility treatments to become pregnant. Individuals who were single or in a same-sex couple and pursuing fertility treatments were also eligible. Individuals experiencing either primary or secondary infertility were eligible. Considering the intervention was intended to alleviate emotional distress related to infertility, only individuals scoring below 70 on the Fertility Quality of Life Tool (FertiQoL) were eligible.[17] However, given that the efficacy of the intervention was unknown, individuals reporting severe psychopathology were excluded and referred to more well-established psychological resources. Specifically, severe anxiety was defined as a score ≥ 15 on the Generalized Anxiety Disorder-7 (GAD-7),[18] and severe depressive symptoms were defined as a score ≥ 20 on the Patient History Questionnaire-9 (PHQ-9).[19] Additional exclusion criteria for the current study included the following: (1) currently participating in psychotherapy, (2) having participated in a formal mindfulness course in the past 6 months, and (3) scoring seven or above on the Suicide Behaviours Questionnaire–Revised, a score range that has been found to have a sensitivity of 0.93 and a specificity of 0.95 in the identification of suicide risk in adult populations.[20] Participants who became pregnant part-way through the intervention were removed from the study, and data were no longer collected on them; however, data collected until that point were included in the analyses.

Procedure

Recruitment and enrollment. The study was advertised via Facebook, Twitter, Instagram, and Reddit between December 2021 and March 2022, and data collection was completed in June 2022. Interested participants were sent an eligibility survey, created using Qualtrics survey software (Qualtrics, Provo, UT, USA). Those deemed eligible were invited to a Zoom enrollment session during which the study was explained and eligibility reconfirmed. Consenting participants were sent the baseline survey, and participants were asked to complete it while waiting for their MSC workbooks to arrive by mail. They notified the researcher once they received it so the researcher could begin assigning chapters to read weekly as well as send out weekly surveys asking about intervention compliance.

The intervention. Each participant was mailed an MSC workbook authored by Drs. Neff and Germer *The Mindful Self-Compassion Workbook: A Proven Way to Accept Yourself, Build Inner Strength, and Thrive*[21] and instructed to download the Center for Mindfulness Studies mobile phone app. The Center for Mindfulness Studies is a mental health charity in Canada. Although the app contains many different types of meditation exercises, participants were instructed on how to "favorite" the MSC-specific meditations on the app so that only the MSC meditations appear. They were asked not to explore the other meditations throughout the 8 weeks.

Once participants received their copy of the MSC workbook and favorited the MSC-specific meditations on the app, they were instructed to let the research team know they were ready to begin the intervention. The intervention length was

8 weeks based on the literature, which confirmed larger effect sizes with interventions between 4 and 12 weeks.[22–25] Each week participants read three assigned chapters in the MSC workbook (each taking approximately 20 min to read) and were instructed to meditate for the suggested time of 30 min each day, as stated by Neff and Germer in their workbook.

Each participant was allowed to keep their copy of *The Mindful Self-Compassion Workbook: A Proven Way to Accept Yourself, Build Inner Strength, and Thrive*. In addition, participants were compensated for their survey completion with Amazon gift cards, $5 for each survey completed. If a participant completed every survey, they would receive $60. If participants discontinued their participation or became pregnant, they were compensated for the surveys that they had completed. It was reasoned that this amount would compensate participants fairly for their time and effort without putting undue pressure to participate. The University of Regina Research Ethics Board approved this study protocol (#2021-133).

Measures

All measures were administered via an online survey, created using Qualtrics survey software. The primary outcome measure for this study was fertility quality of life, assessed using the FertiQoL, while secondary outcomes were anxiety, assessed using the GAD-7, and depressive symptoms, assessed using the PHQ-9. Other prespecified outcomes of interest included intervention credibility and expectancy, treatment satisfaction, negative effects, mindfulness, self-compassion, compassion, and relationship satisfaction. The schedule of measures used throughout the study is summarized in Table 1.

Eligibility survey. An eligibility survey was used to confirm that participants scored sufficiently low on the FertiQoL (<70) to indicate sufficient distress related to their infertility while also scoring below the "severe" range on the GAD-7 and PHQ-9 (<15 for both).

Fertility Quality of Life Tool.[26] The FertiQoL is a 26-item measure examining one's quality of life in relation to their experience of infertility. This questionnaire involves getting participants to reflect on their thoughts and emotions using four subscales: relational, mind–body, social, and emotional. The questionnaire has five separate scales ranging from *Completely* to *Not at All*, *Always* to *Never, Very Poor* to *Very Good*, *Very Dissatisfied* to *Very Satisfied,* and *An Extreme Amount* to *Not at All.* Internal consistency for this scale has been shown to be Cronbach's $\alpha = 0.92$ in past research[26]; in the current study, α was 0.90.

Generalized Anxiety Disorder-7-Item Scale.[18] The GAD-7 is a questionnaire that assesses an individual's symptoms of generalized anxiety. This measure examines the degree to which participants have been bothered over the past 2 weeks by a range of problems and symptoms that they may have experienced. The GAD-7 employs a 4-point Likert scale ranging from 0 (*not at all sure*) to 3 (*nearly every day*). Prior research has found the internal consistency of this scale to be excellent, with $\alpha = 0.92$.[18] In the current study, α was 0.85.

Patient History Questionnaire-9.[27] The PHQ-9 is a nine-item scale ranging from 0 (*not at all*) to 3 (*nearly every day*). This questionnaire was designed to assess symptoms of depression and asks participants to acknowledge how often they have experienced the described situations within the questionnaire over the past 2 weeks. Prior research has found the internal consistency of this measure to be $\alpha = 0.90$[27]; in the current study, α was 0.89.

Baseline survey. The baseline survey included the above-described questionnaires—the FertiQoL, GAD-7, and PHQ-9—along with the following questionnaires.

Demographic and Reproductive Health Information Questionnaire. Participants were asked relevant demographic questions (e.g., current age and gender identity), followed by reproductive history information. This questionnaire was created by the researchers.

The Five Facet Mindfulness Questionnaire-15.[28] The Five Facet Mindfulness Questionnaire-15 (FFMQ-15) is a measure that examines participants' reported levels of mindfulness. This 15-item measure involves a 5-point Likert scale ranging from 1 (*never or very rarely true*) to 5 (*very often or always true*). Internal consistency for the five facet scales has been found to range from 0.75 to 0.91.[28] In the current study, the Cronbach's alpha was 0.84 for the entire scale.

The Self-Compassion Scale.[29] The Self-Compassion Scale (SCS) is a 26-item measure that examines an individual's reported levels of self-compassion. The SCS employs a 5-point scale ranging from 1 (*almost never*) to 5 (*almost always*). Internal consistency for this scale has been found to be $\alpha = 0.92$ in the past research[30]; similarly, Cronbach's α was 0.92 in the current study.

The Compassion Scale.[31] The Compassion Scale (CS) is a 16-item measure that employs the use of a 5-point Likert scale ranging from 1 (*almost never*) to 5 (*almost always*). Prior research has found internal consistency to be Cronbach's $\alpha = 0.8–0.9$[31]; in the current study, α was calculated as 0.91.

Revised Dyadic Adjustment Scale.[32] The Revised Dyadic Adjustment Scale (RDAS) uses three different subscales: the Dyadic Satisfaction Subscale, the Dyadic Cohesion Subscale, and the Consensus Subscale to measure relationship satisfaction. The RDAS is a 14-item scale and ranges from 0 (*always disagree*) to 5 (*always agree*), 0 (*all the time*) to 5 (*never*), and 0 (*never*) to 4 (*every day*), depending upon the subscale. Internal consistency has been found to be $\alpha = 0.90$[32]; in the current study, Cronbach's α was calculated to be 0.77.

Credibility/Expectancy Questionnaire.[33] The Credibility/Expectancy Questionnaire (CEQ) was used to determine participants' expectancy before beginning and how credible they believed the current intervention would be. It is a 6-item measure with a 9-point Likert scale ranging from 1 (*not at all*) to 9 (*very* much) and an 11-point scale ranging from 0% to 100%. Internal consistency has been found to be $\alpha = 0.84$ in the past research[33]; in the current study, Cronbach's α was found to be 0.82.

Weekly survey. The weekly surveys contained the FertiQoL and a homework completion questionnaire.

Table 1. Schedule of Scales Administered Throughout the Study

	Before		*During*		*After*	
Scale	*Eligibility*	*Baseline*	*Weekly*	*Mid-intervention*	*Post-intervention*	*1-month follow-up*
Demographics and reproductive history		X				
Fertility Quality of Life Tool (FertiQoL)	X	X	X	X	X	X
Generalized Anxiety Disorder-7 Scale (GAD-7)	X	X		X	X	X
Patient Health Questionnaire-9 (PHQ-9)	X	X		X	X	X
Five Facet Mindfulness Questionnaire (FFMQ-15)		X			X	X
Self-Compassion Scale (SCS)		X			X	X
The Compassion Scale (CS)		X			X	X
Revised Dyadic Adjustment Scale (RDAS)		X			X	X
Credibility/Expectancy Questionnaire (CEQ)		X				
Homework Completion Questionnaire			X	X		
Treatment Satisfaction Questionnaire (TSQ)					X	
Negative Effects Questionnaire (NEQ)					X	

Homework Completion Questionnaire. The homework completion questionnaire was designed by the researchers for this study. It simply asked participants to identify how much they had read that week and the number of minutes they had spent meditating.

Mid-intervention survey. This survey was given after week 4 and employed the FertiQoL, GAD-7, PHQ-9, and homework check questionnaire described above.

Post-intervention survey. The post-intervention survey was given to participants after week 8 of the intervention. This survey involved participants completing all of the questionnaires included in the baseline survey, except for the demographic and reproductive health information questionnaire and the CEQ. The post-intervention survey also included the homework check questionnaire for week 8 of the intervention and two additional questionnaires described below.

Treatment Satisfaction Questionnaire.[34] The Treatment Satisfaction Questionnaire (TSQ) was used to assess the level of satisfaction that participants felt after completing the 8-week intervention.

The Negative Effects Questionnaire.[35] The measure uses a yes/no scale and contains four items. The Negative Effects Questionnaire (NEQ) is employed to determine whether participants suffered from any adverse effects during the intervention.

Follow-up survey. The follow-up survey was sent to participants 4 weeks after they had completed the intervention. This survey included all of the same questionnaires as the post-intervention survey, except for the NEQ and the TSQ.

Data analysis

Paired *t* tests were conducted to determine if the intervention impacted the predetermined psychological outcomes. Fertility quality of life was considered the primary outcome, while anxiety, depression, mindfulness, self-compassion, compassion for others, and relationship satisfaction were considered secondary. Further analyses were conducted to determine if any observed changes were sustained 1 month post-intervention. Alpha was set to 0.017 using the Bonferroni correction to limit the family-wise error rate. All analyses were completed in SPSS version 28.0.

Since the FertiQoL was administered weekly and the GAD-7 and PHQ-9 were administered at the mid-way point in the intervention, sensitivity analyses were conducted applying the last observation carried forward,[36] allowing all participants to be included in the analysis, including those who withdrew from the study. For individuals who did not remain in the intervention until the mid-intervention survey prior to deciding to discontinue their participation, their baseline GAD-7 and PHQ-9 along with their last completed weekly FertiQol were imputed as the post-intervention scores used in the analysis. For participants who had become pregnant prior to completing the mid-intervention survey, their last completed FertiQol was used in the analysis, but their baseline scores on the GAD-7 and PHQ-9 were not. Since these participants were removed from the study rather than having withdrawn themselves, it was reasoned that using their baseline scores would be overly conservative.

The proportion of participants exhibiting a clinically significant change in their levels of anxiety and depression was also examined. A change of four points was considered clinically significant on the GAD-7,[37] and a change of five points was considered significant for the PHQ-9.[38]

To test whether participant improvement following the MSC intervention exceeded those that would be expected due solely to regression toward the mean, we applied the Mee and Chua algorithm.[39] Specifically, this procedure involves regression post-intervention outcomes on baseline scores adjusted around the population mean and testing the intercept against its null value. In other words, this process provides a statistical estimate of whether the MSC intervention resulted in mental health benefits that are likely to be beyond regression toward the mean. This algorithm was applied to FertiQol, PHQ-9, and GAD-7 scores. The population means for these three outcomes were derived from the waitlist control group of a randomized trial recently completed by the research team, assessed 6 months

postrecruitment into a psychotherapy intervention trial.[40] The recruitment process for this trial was very similar to the current study but did not have any inclusion criteria related to baseline mental health scores and was therefore reasoned to be an appropriate comparator. Thus, the population FertiQol score was assumed to be 55, the population mean PHQ-9 score was assumed to be 7.9, and the population mean GAD-7 score was assumed to be 7.7.

Power calculation

Using G*Power, it was determined that a sample of at least 45 participants would allow us to detect a moderate effect size on each of our continuous outcomes ($d = 0.5$) when applying a paired t test, setting alpha at 0.017, and power at 80%. To account for attrition, we aimed to recruit 50 participants.

Results

Of the 117 who responded to the study ad, 24 individuals did not go on to complete the eligibility survey, 3 were eligible but did not begin the intervention, and 40 were ineligible for a variety of reasons: appearing fraudulent in their responses to the eligibility survey ($n = 8$), scoring within the severe range on the GAD-7 and/or PHQ-9 ($n = 25$), having participated in a formal mindfulness course within the past 6 months ($n = 1$), currently attending weekly psychotherapy ($n = 3$), or endorsing high suicidal risk ($n = 3$). Finally, 50 participants began the intervention.

Participant ages ranged from 26 to 42 years, with 73% of participants being aged 30 years or older. The sample was predominantly married, heterosexual, white, and university-educated. Unexplained infertility and repeated pregnancy loss were the most commonly reported sources of infertility. A more detailed account of participant characteristics is shown in Table 2.

Table 2. Participant Characteristics

	M (SD) or N *(%)*
Age	34.0 (3.9)
Relationship status	
Married/common law	47 (94%)
Never married/never living common law	2 (4%)
Not listed	1 (2%)
Gender identity	
Cis-gendered woman	48 (96%)
Gender fluid/nonbinary	2 (4%)
Sexual orientation	
Heterosexual	44 (88%)
Lesbian	3 (6%)
Bisexual	2 (4%)
Asexual	1 (2%)
Ethnicity	
Arab	2 (4%)
Black	2 (4%)
Chinese	2 (4%)
Latin American	4 (8%)
South Asian (e.g., East Indian, Pakistani, Sri Lankan)	5 (10%)
West Asian (e.g., Afghan, Iranian)	1 (2%)
White	38 (76%)
Not listed	2 (4%)
Annual household income	
$30,000–$69,000	3 (6%)
$70,000–$99,000	5 (10%)
$100,000 and over	41 (82%)
Prefer not to answer	1 (2%)
Education	
Some postsecondary education	3 (6%)
Postsecondary certificate or diploma	5 (10%)
Postsecondary bachelor's degree	14 (28%)
Graduate degree	28 (56%)
Sources of infertility (multiple could be selected)	
Unexplained	27 (54%)
Repeat pregnancy loss	13 (26%)
Diminished ovarian reserve	8 (16%)
Thyroid disorder	8 (16%)
Male factor infertility	5 (10%)
Other sources	8 (16%)
Polycystic ovarian syndrome	4 (8%)
Tubal blockage	4 (8%)
Endometriosis	3 (6%)
Blood clotting factor	3 (6%)
Absence of a reproductively matched partner	2 (4%)
Fertility treatments	
None	11 (22%)
Ovulation induction	7 (14%
Intrauterine insemination (IUI)	15 (30%
In vitro fertilization (IVF)	17 (34%)
Use of donor gametes	3 (6%)

SD, standard deviation.

Adherence and treatment credibility

Of the 50 participants enrolled, 40 completed the entire intervention. Two participants dropped out of the intervention due to personal adverse events, three dropped out for undisclosed reasons, and five had to discontinue their participation because they became pregnant during the intervention. Of the 40 completers, 37 participants completed the 1-month follow-up survey. All three participants who did not complete the follow-up survey had become pregnant within the 4 weeks between the post-intervention survey and the follow-up.

The mean number of self-reported chapters read per participant was 18 out of 24 in the MSC Workbook, with a standard deviation (SD) of 6.2. The mean total number of minutes meditating throughout the 8-week intervention was M(SD) = 837 (293) or roughly 15 min of meditating each day. Participants' responses to the CEQ indicate that they were confident in the intervention before beginning the 8-week program (Table 3).

Psychological outcomes

Reports of fertility-related quality of life, anxiety, depression, mindfulness, and self-compassion all improved during the 8 weeks, with no statistically significant difference in relationship satisfaction or compassion for others. Of the 40 participants who completed the intervention, 20 experienced a clinically significant decrease on the GAD-7, and 18 experienced a clinically significant decrease on the PHQ-9.

Table 3. Responses to the Credibility and Expectancy Questionnaire (CEQ) ($N = 50$)

	M (SD)
How logical does the 8-week MSC self-help program seem? (1–10)	7.5 (1.5)
How successful do you think the program will be in reducing your symptoms? (1–10)	6.4 (1.4)
How confident would you be in recommending it to a friend? (1–10)	6.2 (1.9)
How much improvement in your symptoms do you think will occur? (1–100)	58.4 (18.7)
How much do you really feel that the program will help you to reduce your symptoms? (1–10)	5.8 (1.5)
How much improvements in your symptom do you really feel will occur? (1–100)	52.4 (21.0)

Details regarding the paired *t* test results using the last observation carried forward technique can be observed in Table 4. This illustrates the changes from baseline to post-intervention and from baseline to follow-up, 4 weeks after participants had completed the 8-week intervention. The paired *t* tests were also conducted from baseline to post-intervention for the 24 individuals who had reported clinically significant depressive or anxious symptoms at baseline (Table 5).

Ratings on the TSQ were indicative of overall participant satisfaction (Table 6). Five participants reported that they experienced adverse effects from participating in the intervention: three reported the intervention brought up difficult emotions, and one expressed difficulty when meditations would ask them to think of themselves as a beloved child. One noted that some meditations brought up symptoms of anxiety for them. Three participants experienced new psychological symptoms during the intervention.

Applying Mee and Chua's algorithm showed that improvements on the FertiQol ($F [1, 48] = 17.2$, $p < 0.001$), PHQ-9 ($F (1, 46) = 15.8$, $p < 0.001$), and GAD-7 ($F [1, 46] = 6.9$, $p = 0.012$) were significantly greater than those expected to result from regression toward the mean.

Discussion

The current study examined the efficacy and feasibility of an 8-week self-directed MSC program in decreasing infertility-related distress. Results demonstrate that the intervention was well accepted and associated with reductions in anxiety and depression and increases in fertility-related quality of life, mindfulness, and self-compassion. Of the 50 women who enrolled in the study, 5 dropped out prematurely (10%). This rate is quite favorable in light of a recent meta-analysis of online-based trials for depression observing a dropout rate across studies of 50%.[41] Adherence to the bibliotherapy portion of the intervention was also high, with participants reading an average of 75% of the workbook. These results suggest that MSC is a promising intervention that is well received in this population. It appears that this modality of delivery is feasible with more favorable dropout rates compared with other studies.[41–43]

Symptoms of anxiety and depression showed a large decline from baseline to post-intervention and remained low at the 1-month follow-up assessment. Overall, half of participants experienced what would be considered a clinically significant decline in symptoms of depression or anxiety. Effect sizes were particularly large among the participants reporting clinically significant levels of anxiety and depression at baseline. These results align with previous in-person MSC interventions.[44–46] Effect sizes obtained are also comparable to those seen in other bibliotherapy studies in the literature, which have reported similarly large effect sizes (Hedge's g = 0.82–0.86) for reductions in symptoms of anxiety and depression.[13,47] The current study observed larger effect sizes than stand-alone mobile mental health application interventions (Hedge's g = 0.33–0.38).[22,23]

Large increases in fertility-related quality of life were also observed over the 8-week intervention and remained significantly improved at follow-up. All four subscales on the FertiQoL—emotional, mind–body, relational, and social—showed significant improvements. Effect sizes observed are

Table 4. Pre-to-Post Changes in Mental Health Outcomes in the Entire Sample

				Pre vs. Post				*Pre vs. Follow-up*			
	Pre M (SD)	*Post M (SD)*	*Follow-up M (SD)*	T	*df*	p	*Cohen's d*	T	*df*	p	*Cohen's d*
FertiQol											
Total	49.3 (11.9)	62.3 (12.1)	62.0 (12.6)	5.7	49	<0.001	0.81	5.1	49	<0.001	0.72
Emotion	36.3 (13.3)	54.6 (18.8)	56.3 (17.1)	5.9	49	<0.001	0.83	7.0	49	<0.001	0.99
Mind–body	43.8 (17.1)	61.7 (20.4)	61.3 (20.0)	5.1	49	<0.001	0.72	4.9	49	<0.001	0.69
Relational	68.3 (15.0)	79.6 (14.2)	80.0 (15.4)	4.4	49	<0.001	0.62	3.7	49	<0.001	0.53
Social	47.5 (14.6)	62.1 (12.9)	62.9 (12.1)	5.7	49	<0.001	0.81	5.9	49	<0.001	0.83
GAD-7	9.6 (4.0)	6.0 (4.5)	7.0 (4.3)	–4.4	47	<0.001	–0.64	–3.4	47	<0.001	–0.49
PHQ-9	9.3 (4.1)	5.5 (4.7)	6.0 (4.7)	–4.8	47	<0.001	–0.69	–4.1	47	<0.001	–0.59
FFMQ-15	43.9 (8.3)	52.0 (7.8)	52.0 (7.4)	5.4	47	<0.001	0.79	5.9	47	<0.001	0.85
RDAS	52.3 (5.1)	52.6 (5.1)	53.0 (6.1)	0.3	47	0.772	0.04	0.39	47	0.695	0.06
SCS	2.6 (0.5)	3.2 (0.8)	3.2 (0.8)	5.8	47	<0.001	0.84	5.3	47	<0.001	0.77
CS	4.1 (0.5)	4.3 (0.5)	4.3 (0.5)	1.7	47	0.095	0.25	1.3	47	0.191	0.191

CS, Compassion Scale; FertiQoL, Fertility Quality of Life; FFMQ-15, Five Facet Mindfulness Questionnaire-15; GAD-7, Generalized Anxiety Disorder 7-item Scale; PHQ-9, Patient Health Questionnaire-9; RDAS, Revised Dyadic Adjustment Scale; SCS, Self-Compassion Scale.

Table 5. Pre-to-Post Changes in Mental Health Outcomes Among Participants Endorsing Clinically Significant Depressive and Anxious Symptoms at Baseline

Outcome	*Pre-intervention mean (SD)*	*Post-intervention mean (SD)*	t	*df*	p	*Cohen's d*
Fertility Quality of Life (FertiQoL)	42.4 (8.3)	59.0 (11.8)	5.3	23	<0.001	1.08
Anxiety (GAD-7)	11.2 (2.9)	5.9 (3.8)	−6.8	23	<0.001	−1.39
Depressive symptoms (PHQ-9)	10.5 (3.1)	5.9 (3.7)	−4.5	23	<0.001	−0.92
Mindfulness (FFMQ-15)	40.1 (7.3)	51.1 (7.4)	5.3	23	<0.001	1.08
Relationship satisfaction (RDAS)	50.5 (5.8)	51.1 (5.0)	0.7	23	0.517	0.13
Self-Compassion (SCS)	2.6 (0.5)	3.4 (0.7)	5.5	23	<0.001	1.13
Compassion (CS)	4.1 (0.5)	4.3 (0.4)	2.8	23	0.005	0.58

CS, Compassion Scale; FertiQoL, Fertility Quality of Life; FFMQ-15, Five Facet Mindfulness Questionnaire-15; GAD-7, Generalized Anxiety Disorder 7-item Scale; PHQ-9, Patient Health Questionnaire-9; RDAS, Revised Dyadic Adjustment Scale; SCS, Self-Compassion Scale; SD, standard deviation.

larger than those observed in other mindfulness-based interventions for infertility,[4] suggesting that explicit focus on self-compassion may lead to meaningful improvements in reports of fertility-related quality of life.

As expected, self-reported mindfulness and self-compassion significantly improved over the 8-week intervention and remained significant at the follow-up. The observed changes are similar to those reported by other studies examining in-person and online mind–body interventions.[45,48,49] Previous research indicates that self-compassion plays a vital role in psychological resilience and well-being.[50–52] Relevant to this sample of women, self-compassion has been shown to have

Table 6. Treatment Satisfaction and Reported Adverse Effects

	N *(%)*
Treatment satisfaction	
Would you recommend the intervention to a friend?	
Yes	34 (92)
No	3 (8)
Was the intervention worth your time?	
Yes	36 (97)
No	1 (3)
How satisfied were you with the intervention?	
Dissatisfied	0
Neutral	5 (14)
Satisfied	26 (70)
Very satisfied	6 (16)
How satisfied were you with the quality of the materials?	
Dissatisfied	0
Neutral	7 (19)
Satisfied	22 (60)
Very satisfied	8 (22)
How has the intervention affected your confidence in managing your symptoms?	
Greatly reduced	2 (5)
No change	3 (8)
Increased	27 (73)
Greatly increased	5 (14)
How has the intervention affected your motivation to seek treatment if needed in the future?	
Reduced	1 (3)
No change	12 (32)
Increased	14 (38)
Greatly increased	10 (27)
Adverse effects	
Did you experience any negative effects of treatment?	
Yes	5 (13)
No	33 (87)
Did you experience any new psychological symptoms while working through the intervention?	
Yes	3 (8)
No	35 (92)
Did you experience any unwanted events during the intervention? (e.g., death of a family member)	
Yes	8 (21)
No	30 (79)

important psychological benefits in the perinatal period as well.[53] It is therefore possible that the MSC skills developed with the current intervention may continue to benefit women throughout pregnancy and the postpartum period.

Relationship satisfaction did not significantly improve throughout the intervention. Although there is support in the literature for self-compassion improving relationship satisfaction in general,[54–56] it is important to consider that the mean relationship satisfaction was quite high. Indeed, 80% of participants scored in a range that would indicate good relationship satisfaction. A ceiling effect may therefore have been at play. Relatedly, compassion for others also did not change over the 8-week intervention. Although, in the literature, it has been shown that MSC interventions can also lead to increases in levels of compassion for others,[57] a ceiling effect may also have been at play for this outcome considering that the mean baseline score on the compassion scale was 4.1 out of a 5-point scale.

A surprising 8 out of 50 participants became pregnant either during the intervention period or the follow-up period. Although it cannot be concluded that these pregnancies occurred because of the intervention, such a conclusion would be consistent with the well-established finding that participation in psychological interventions increases the likelihood of becoming pregnant by about 25% for those experiencing infertility.[4,58]

The results of this study indicate the clinical utility of a self-administered 8-week MSC intervention for reducing distress in individuals attempting to conceive and experiencing involuntary childlessness. However, the lack of associations between the number of chapters read and the outcome variables suggests that a shorter intervention may result in similar psychological changes. This is supported by the finding that prior MSC studies of interventions, 3 weeks or less, are associated with significant improvements in psychological outcomes.[14,59,60] It also remains to be seen whether the meditation component of the intervention was actually needed, considering that the number of minutes spent meditating was not correlated with psychological outcomes. This is especially worth considering given that one of the main comments emerging from the written participant feedback was that participants felt that the 30 min of suggested meditation each day was too demanding. In contrast, participants wrote about how much they enjoyed the interactive exercises contained in the MSC workbook.

Strengths and limitations

These findings should be interpreted with the following limitations in mind. First, as this study was an uncontrolled trial, it is possible that participants improved simply because of the passage of time. Since a minimum level of distress was required for study eligibility, regression toward the mean would be expected and could have possibly accounted for the pre–post improvements observed. However, in applying the Mee and Chua algorithm, it was found that the improvements observed are likely to be above and beyond what would be expected to result from regression toward the mean, thereby supporting the current MSC intervention as a promising treatment for infertility-related distress. Still, since nonspecific factors such as interaction with the researcher, treatment expectations, or greater attention paid to one's mental health could all help account for the observed improvements, a randomized controlled trial comparing the current intervention to an active control group is warranted. A longer-term follow-up should also be conducted to determine if the changes are still maintained for more than 1 month post-intervention. Second, although the participant sample was fairly representative of the ethnic diversity observed in North America, the average annual income and education were considerably higher. Those with more privileged positionality in society may have different outcomes, and the feasibility of the study may be different for those experiencing systemic inequities. Although the current study had limitations, there were also many strengths. First, the attrition rate of the current study was relatively low, with 80% of participants completing the entire intervention. This is much higher than attrition rates reported in other similar studies in the literature that were administered within populations of women experiencing infertility.[61]

Conclusion

The present findings suggest that a self-guided intervention combining an MSC workbook and meditations delivered via a mobile application may be effective in improving mental health among women experiencing distress related to infertility. Although treatment effects were found to be larger than those expected from regression toward the mean, a fully powered randomized controlled trial is warranted. In the meantime, though, the MSC workbook used in the current study is readily available for purchase, and the mobile application is available free of charge, thereby offering a highly accessible and cost-effective option for those who otherwise lack access to mental health care.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Author Disclosure Statement

The authors declare that they have no conflict of interest.

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Supplementary Material

Supplementary Data

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