Principles and Practice of Clinical Research
A GLOBAL JOURNAL OF CLINICAL RESEARCH

Effectiveness of Remote Mindfulness Interventions in Reducing Depressive Symptoms During Pregnancy and the Postpartum Period: A Systematic Review and Meta-analysis

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Abstract

Aim: *This systematic review examines the effectiveness of mobile and remote mindfulness interventions in reducing depressive symptoms during the perinatal period, which includes both pregnancy and the postpartum period.*

Background: *Postpartum depression is highly prevalent in women and can contribute to up to 20% of maternal mortality, affecting the health of both mother and child. Effective treatment is a challenge and findings on remote mindfulness interventions show promising results.*

Methods: *A comprehensive search was conducted in PubMed and Cochrane Library on May 4th, 2024, investigating randomized controlled trials in pregnant women. A meta-analysis was performed on seven studies assessing the impact of remote mindfulness interventions on depressive symptoms measured with the Edinburgh Postnatal Depression Scale (EPDS).*

Results: *A total of 997 studies were screened, with 7 studies included in the final analysis. A meta-analysis of four studies on the reduction of EPDS scores immediately post-intervention was conducted. Significantly lower EPDS scores were observed in the intervention group compared to the control group immediately post-intervention (mean difference -1.93; 95% CI -3.78 to -0.08; $P = 0.04$, $I^2 = 81\%$, $P < 0.01$; high heterogeneity). A second meta-analysis on the persistence of effects through the postpartum period showed non-significant differences between the groups (mean difference -2.63; 95% CI -6.13 to 0.86; $P = 0.14$, $I^2 = 91\%$, $P < 0.01$; high heterogeneity).*

Conclusion: *Mindfulness interventions delivered through mobile health applications have the potential to reduce depressive symptoms during pregnancy and the postpartum period.*

Introduction

Postpartum depression (PPD) affects between 5% and 26% of women globally and contributes to 5% to 20% of maternal mortality (Liu et al., 2022; Miura et al., 2023). In the United States, the prevalence of PPD increased from 9.4% to 19.3% over a decade (Goodman, 2009). Around 24% of women experience PPD one year postpartum, with relapse rates up to 40%, which affects both their health and bonding with their child (Campbell & Cohn, 1997; Goodman, 2004; Stewart & Vigod, 2016). There is no consensus on the definition of the postpartum period, although most consider it to last from six months to one year after delivery (Qin et al., 2022). The main signs and symptoms of PPD include depressed mood, loss of interest and joy, sleep and appetite disturbances, decreased concentration, feelings of worthlessness or guilt, and negative thoughts about the infant or motherhood (Daehn et al., 2023). These symptoms can vary from mild to severe, patients may resort to substance use, self-harm, or in extreme situations, suicide (Stewart & Vigod, 2016). PPD also affects the child's health, as there may be issues with breastfeeding, adherence to immunization schedules (Dennis & McQueen, 2007; Zajicek-Farber, 2009), and conflicting behavior (Kingston et al., 2018). Despite the known risks, many women face barriers to access adequate preventive and treatment measures, such as lack of time, stigma, and childcare issues (Goodman, 2009; O'Mahen & Flynn, 2008).

Diagnosing PPD still relies on clinical evaluation, but the U.S. Preventive Services Task Force recommends (USPSTF) applying the 10-item Edinburgh Postnatal Depression Scale (EPDS) to screen pregnant and postpartum women without specifying a cut-off value (Siu et al., 2016). A score of 11 or higher provides the best balance between sensitivity (81%) and specificity (88%), even when applied to different groups, such as pregnant versus postpartum status (Levis et al., 2020; Hewitt et al., 2009).

In recent years, mindfulness-based interventions during pregnancy have been suggested to improve mental health and pregnancy outcomes. Mindfulness is observing the present moment without judgment, often achieved through meditation (APA Dictionary of Psychology, n.d.). It can help in understanding the causes of maternal depression, providing targeted training based on these causes. Currently, mindfulness interventions usually include two types: Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT) (Hofmann & Gómez, 2017).

The World Health Organization (WHO) defines mobile health (mHealth) as the use of mobile technologies, including cell phones, computers, telemedicine, medical informatics, technology transfer, and data collection (Miura et al., 2023). Recently, application (app)-based treatments have been proposed to address PPD, given their accessibility and ease of delivery. A recent study assessed the acceptability of mobile health apps to monitor and evaluate perinatal depression and anxiety, showing that mHealth can effectively track mood symptoms in pregnant and postpartum women (Varma et al., 2023). Among the reported benefits of app-based treatments are improvements in sleep, reductions in pain and preeclampsia risk, management of weight gain, and enhanced recovery after pregnancy loss (Green et al., 2022).

Mobile health applications have gained popularity as potential tools for mental health monitoring and intervention, but their effectiveness in addressing perinatal depression remains understudied. There is a need for rigorous evaluation of remote mindfulness interventions to assess their impact on perinatal depression symptoms, adherence, and accessibility across diverse populations. This systematic review and meta-analysis aims to evaluate the effectiveness of mindfulness interventions delivered through mHealth applications in improving perinatal depression symptoms, as measured by the EPDS, as well as pregnancy-related anxiety scores, perceived stress, sleep quality, memory, and fatigue. These interventions include established mindfulness approaches, such as counseling, educational programs, cognitive behavioral therapy, motivational interviewing, and supportive care for postpartum women, delivered remotely through a software platform during pregnancy and the postpartum period.

Materials and Methods

Eligibility criteria

The eligibility criteria established for the studies were: pregnant patients from 18 to 45 years, with completed follow-ups for all trimesters, comparison between pregnant women who used mindfulness interventions through mHealth and pregnant women who did not receive any intervention; evaluation of clinical outcomes of interest, such as EPDS or depression symptoms; randomized controlled trials. Studies were excluded that included patients with

*Corresponding author: maria.yemane-2024@ppcr.org
Received: July 27, 2024 **Accepted:** November 19, 2024
Published: June 29, 2025
Editor: Felipe Fregni
Reviewers: Wilson Fandino, Julia Minetto, Bassel Almarie, Clara Maria Raggio
Keywords: Postpartum Depression, Mindfulness mHealth, Pregnancy, Edinburgh Postnatal Depression Scale, Prevention
DOI: https://doi.org/10.21801/ppcrj.2025.11.3

previous mental health symptoms and were on medical treatment for depression or presented health problems prior to the current pregnancy, as well as studies that included patients with a history of substance abuse or addiction.

Primary and secondary outcomes

The primary outcome is the change in depressive symptoms (EPDS score $\geq$9), while secondary outcomes include various measures of anxiety, stress, mood, mindfulness, sleep, memory, delivery expectations, fatigue, and infant neurodevelopment, assessed at multiple points during pregnancy and postpartum period.

Search strategy and data extraction

A systematic search was conducted on May 4th, 2024, using two electronic databases, PubMed and Cochrane Central Register of Controlled Trials, with the search terms: 'pregnancy,' 'postpartum,' 'pregnant,' 'meditation,' 'mobile-based,' 'mindfulness,' 'mental health,' and 'depression.' The complete search strategy is provided in the appendices. No database filters were used, and only the articles available in English were selected. The search results were uploaded to Covidence, an online systematic review management tool, which automatically removes duplicates. Initially, 28 researchers screened the studies based on their titles and abstracts on April 5th, 2024. The full-text was assessed for eligibility criteria based on predefined inclusion and exclusion criteria and was completed on May 8th, 2024. For the full-text review and data extraction, two researchers independently reviewed each article, and resolved any disagreements through discussion, if needed by consulting a third reviewer.

Quality assessment

The quality assessment of the included studies was performed using the Cochrane Collaboration's tool for assessing risk of bias in randomized trials (RoB 2). Two independent researchers evaluated the risk of bias in the randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result using a scale of 'low risk', 'high risk', or 'some concerns', with the help of a third reviewer if needed (Figure 2).

Statistical analysis

This systematic review and meta-analysis were conducted according to the guidelines of the Cochrane Collaboration and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement. The statistical analysis was performed using Review Manager (RevMan, Cochrane, Version 5.4). Random effects model with the inverse variance method was used to compare the mean difference (MD). I^2, chi-square, and their p-values were used to assess heterogeneity, supplemented by a visual inspection of the forest plot.

Results

Identification and selection of studies

A comprehensive search was conducted from May 4, 2024, to May 27, 2024, including a screening of titles and abstracts. Subsequently, from June 2 to June 25, 2024, full-text reading and data extraction were performed. The flow diagram of the study screening and selection process is shown in Figure 1. Initially, 1,193 studies were identified from two databases (PubMed and Cochrane), and 196 duplicates were removed. After screening titles and abstracts, 108 references were selected for full-text review. Of these, 101 were excluded for not fulfilling the eligibility criteria. Ultimately, 7 studies were included in the systematic review, all of which were peer-reviewed (Table 1). All included studies were parallel-group randomized controlled trials (RCTs) involving pregnant women. The earliest study began in July 2018, and the most recent in November 2023. The participation period of the studied subjects ranged from 4 to 52 weeks. Due to the nature of the interventions, all trials were open-label. The studies were conducted in China (n=3), the Netherlands (n=1), Germany (n=1), England (n=1), and Iran (n=1). In all studies, interventions were introduced in the second trimester except for Jannati et al., which focused exclusively on the postpartum period.

Characteristics of included studies

Among the seven included clinical trials, the number of participants ranged from 75 to 460, with a median of 168 (IQR: 83.5). The mean age of participants varied across studies, ranging from 27 to 32.7 years, representing a sample of women primarily in their late twenties to early thirties. The recruited participants were primigravida and multigravida women, who were all at least in their second trimester of pregnancy. Leng et al. (2023) additionally described the complications during pregnancy, including preterm delivery, thyroid dysfunction, gestational diabetes, and abnormal placenta implantation.

Regarding marital status, six studies reported mar-

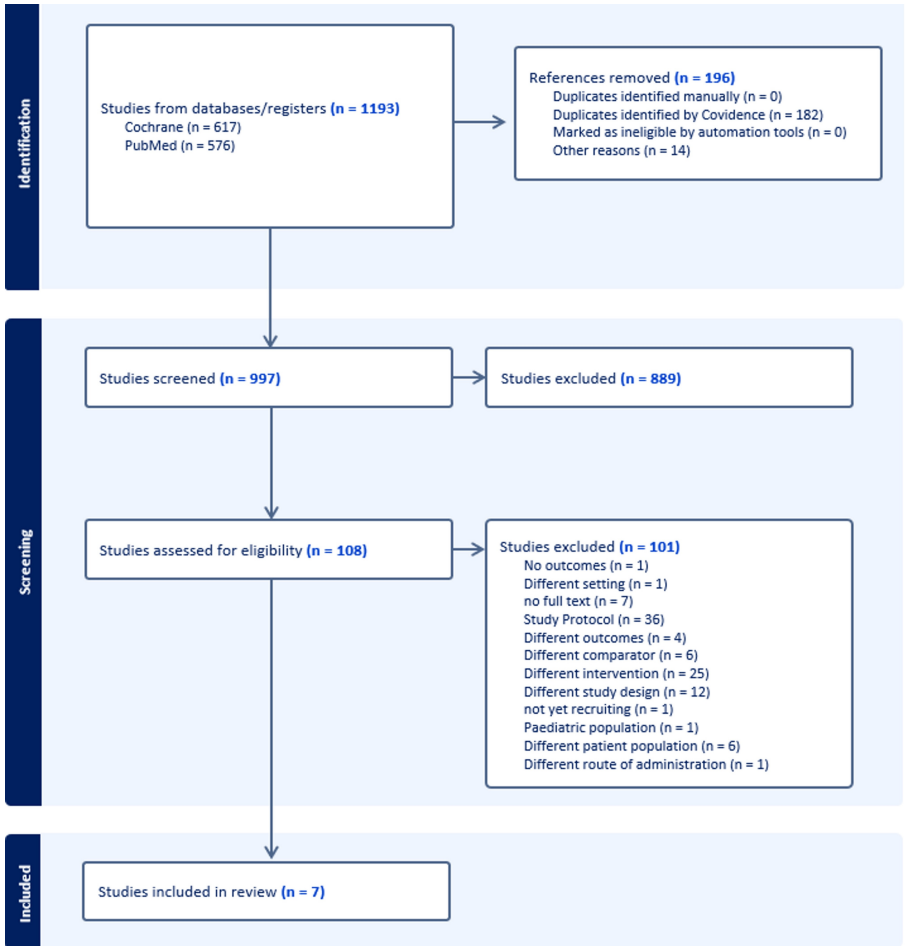

Figure 1: *Study flow diagram from May 4, 2024.*

First Author, country and year of publication	T1 (Baseline)	T2	T3	T4	T5	T6	T7
Hulsbosch LP et al, Netherlands, 2023.	12th week of gestation	Halfway through the intervention: (20th week of gestation)	Post 8 week intervention (28th week of gestation)	36th week of gestation	N/A	N/A	N/A
Zhang X et al, China, 2023.	12-20th week of gestation.	Post 8-week intervention (20-28th week of gestation)	36-37th week of gestation.	6th week postpartum.	3 months postpartum.	6 months postpartum	N/A
Leng LL et al, China, 2023.	12-28th week of gestation.	Post 8-week intervention intervention (20-36th week of gestation)	37th week gestation	4–6th week postpartum	N/A	N/A	N/A
Hassdenteufel K et al, Germany, 2023	28th Gestational week.	30th Gestational week	32nd Gestational week	34th Gestational week	Post intervention - 36th Gestational week	1 month postpartum	5 months postpartum
Sun Y et al. 2021, China	12-20th week of gestation.	Halfway through the 8-week intervention: (16th-20th weeks of gestation)	Post 8 week intervention (20th-28th week of gestation)	18 weeks after group allocation.	6 weeks after delivery	N/A	N/A
Krusche A et al, England, 2015	12-28th week gestation.	45 days after baseline survey completion (19-36th week of gestation)	N/A	N/A	N/A	N/A	N/A
Jannati N et al, Iran, 2020.	0 to 6 months postpartum -	Post-intervention - 8 weeks after group allocation	N/A	N/A	N/A	N/A	N/A

Table 1: *Study characteristics.*

ital data, with most participants being married or in a partnership, averaging 97.7% across the studies. Specifically, Sun et al. (2021) and Leng et al. (2023) reported 100% married participants, while Hulsbosch et al. (2023) indicated 93.6% living with a partner. The remaining studies had similarly high rates, with a small proportion of single or divorced individuals (1.3%).

Ethnic and racial representation varied by study location. In the three studies conducted in China (Zhang et al., 2023; Leng et al., 2023; Sun et al., 2021), Han ethnicity predominated, accounting for over 98% of participants in Zhang et al. (2023) and Sun et al. (2021). European populations were also represented, with Krusche et al. (2018) focusing on British participants, Hulsbosch et al. (2023) on Dutch participants, and Hassdenteufel et al. (2023) on German participants. Socioeconomic status and education levels varied across studies. Most participants had formal education, with high percentages holding advanced qualifications: Hulsbosch et al. (2023) reported that 72.5% of the intervention group and 65.5% of the control group had higher education. Krusche et al. (2018) indicated that 40.3% had a degree, and an additional 40.3% held a postgraduate qualification. In Leng et al. (2023), 90.7% of participants had a college education or higher, while Jannati et al. (2020) noted that 23.68% of participants exceeded postgraduate levels.

Hulsbosch et al. (2023), Jannati et al. (2020), and Zhang et al. (2023) categorized participants' economic status based on monthly income in local currency. In contrast, Hulsbosch et al. (2023) and Krusche et al. (2018) focused solely on employment rates, reporting high employment levels among participants. Specifically, Hulsbosch et al. (2023) noted employment rates of 97.2% in the intervention group and 97.3% in the control group, while Krusche et al. recorded 76.4% employment. Other studies reported similar employment data, with Sun et al. (2021) showing 76.7% employment and Leng et al. (2023) showing 81.3%.

Characteristics of intervention

Most authors used app-based interventions (Zhang et al., 2023; Leng et al., 2023; Hassdenteufel et al., 2023; Sun et al., 2021; Jannati et al., 2020), others used web-based platforms exclusively (Hulsbosch et al., 2023; Krusche et al., 2018). The interventions included mindfulness activities such as body scans, mindful movement, breathing exercises, and managing thoughts and emotions (Krusche et al., 2018; Sun et al., 2021; Hulsbosch et al., 2023; Zhang et al., 2023). Two articles combined mindfulness with cognitive behavioral therapy (Leng et al., 2023; Hassdenteufel et al., 2023), while one focused solely on cognitive behavioral therapy (Jannati et al., 2020).

The digital applications consisted of audio files, videos, written content, personal "skill boxes", and interactive worksheets; one study incorporated lessons that read like a storybook (Jannati et al., 2020). These apps were developed as platforms exclusively for the trials.

Most interventions lasted eight weeks, with some exceptions: Zhang et al. (2023) for six weeks, and Krusche et al. (2018) for four weeks. Intervention frequencies varied widely: weekly (Jannati et al., 2020; Leng et al., 2023), daily (Hulsbosch et al., 2023; Zhang et al., 2023), three times per week (Sun et al., 2021), biweekly (Hassdenteufel et al., 2023), and at the participant's discretion at least once a week (Krusche et al., 2018). Session durations included one hour (Jannati et al., 2020; Hulsbosch et al., 2023), ten minutes (Zhang et al., 2023), or were unspecified.

The control groups typically received standard perinatal care, as seen in studies by Krusche et al., (2018), Jannati et al., (2020), Zhang et al., (2023), Hulsbosch et al., (2023) and Hassdenteufel et al., (2023). Exceptions were Leng et al. (2023), which provided perinatal education modules and Sun et al. (2021), with weekly health consultations through Wechat.

Primary outcomes

All authors measured EPDS as part of their primary outcomes to quantify depressive symptoms, defining a score of $\geq$9 as a positive screening for depressive symptoms. Baseline EPDS scores were taken from the 12th to the 20th week of gestation, except for Hassdenteufel et al., who started at the 28th week, and Leng et al., who extended from the 12th to the 28th week. The studies had varied objectives: reducing stress (Krusche et al., 2018), improving PPD (Jannati et al., 2020; Hulsbosch et al., 2023), and enhancing prenatal mental health (Sun et al., 2021; Zhang et al., 2023). Outcomes also focused on maternal mental health and emotional well-being (Hassdenteufel et al., 2023; Leng et al., 2023).

The frequency of outcome measurement varied across studies. Zhang et al. (2023) measured the EPDS score three times during pregnancy and three times postpartum, while Hulsbosch et al. (2023) measured depression scores four times during pregnancy. The second and third screenings were performed at different times: from the 16th to the 37th week, immediately after the intervention, and a follow-up at least four weeks apart. Hulsbosch et al. (2023), Hassdenteufel et al. (2023), and Sun

et al. (2021) also performed screenings during the intervention. Jannati et al. (2020) only assessed EPDS scores before and after the eight-week intervention, which occurred entirely during the postpartum period. EPDS scores were reported as means and standard deviations. A detailed timeline is presented in the appendices (6.2).

Secondary outcomes

Most studies also measured, with the same frequency as the EPDS, pregnancy-related anxiety (Hulsbosch et al., 2023; Zhang et al., 2023; Hassdenteufel et al., 2023; Krusche et al., 2018) and/or anxiety (Zhang et al., 2023; Hassdenteufel et al., 2023; Sun et al., 2021; Krusche et al., 2018) as secondary outcomes. Other secondary outcomes included perceived stress (Sun et al., 2021; Krusche et al., 2018), changes in general mood, and labor worry. Sun et al. (2021) also included sleep quality, prospective and retrospective memory, delivery expectancy, and fatigue severity as secondary outcomes. Zhang et al. (2023) measured the impact of mindfulness on infant neurodevelopment.

Effects of interventions

Four of the seven studies (Zhang et al., 2023; Leng et al., 2023; Sun et al., 2021; Krusche et al., 2018) reported a significant intervention effect, shortly after concluding their intervention periods (6-8 weeks after allocation), on EPDS score reduction with significant difference between the groups across measurement timepoints (Time $\times$ Group effect). The significant effects were associated with at least medium effect sizes, Cohen's d ranging from 0.47 to 1 at the last reported time point for Zhang et al. (2023), Leng et al. (2023) and Sun et al. (2021), and an eta-squared of 0.13 in Krushche et al. (2018). Score differences between the intervention and control group ranged from -2.51 to -6.3 points. Zhang et al. (2023) and Leng et al. (2023) additionally reported persistent, significant differences at least one month after the intervention stopped during the postpartum period.

Three of the seven studies (Zhang et al., 2023; Hassdenteufel et al., 2023; Sun et al., 2021) investigated differences in anxiety symptoms, while four (Zhang et al., 2023; Hassdenteufel et al., 2023; Hulsbosch et al., 2023; Krusche et al., 2018) investigated pregnancy-related anxiety (Table 1).

Significant differences in anxiety symptoms at the end of the intervention period between groups were reported by Zhang et al., (2023) (MD = -1.52, 95% CI: -2.92 to -0.13, p = 0.03 , Cohen's d = 0.53) and Sun et al., (2021) (group $\times$ time ANOVA: χ^2_4 =13.1, p=0.01, Cohen's d = 0.46), both measuring the outcome with Generalized Anxiety Disorder 7 (GAD-7) questionnaire. Negative results were reported by Hassdenteufel et al. (2023), utilizing the State-Trait Anxiety Inventory (STAI).

Regarding pregnancy-related anxiety, significant differences favoring the intervention group at the end of the intervention period were reported by Zhang (2023) (MD = -4.92, 95% CI: -6.60 to -3.23, p <.001, Cohen's d = 0.89), Hassdenteufel et al. (2023) (group $\times$ time ANOVA, p = 0.012, η^2 = 0.015, ω^2 = 0.007), and Krusche et al. (2018) (group $\times$ time ANOVA, p<0.05, η^2 = 0.17). Hulsbosch et al. (2023) found no significant differences.

Three of the seven studies (Leng et al., 2023; Sun et al., 2021; Krusche et al., 2018) measured perceived stress utilizing the Perceived Stress Scale (PSS). Two of the seven studies, Krusche et al. (2018) and Sun et al. (2021), reported no significant difference between intervention and control groups at the end of the intervention period, while Leng et al. (2023) showed significant differences with a mean difference of -3.8 (95% CI: -6.02 to -1.58, p= 0.001, Cohen d = -0.8).

Assessment of risk of bias in individual studies

Two out of seven included studies were found to have a low risk of bias in all domains according to the revised tool to assess the risk of bias in randomized trials (RoB 2). Regarding the remaining five studies, three were assessed to have a high risk of bias concerning the measurement of the outcome and missing outcome data. The risk of bias was unclear in three studies regarding the randomization process and in two studies concerning deviations from the intended intervention. In particular, Krusche et al. (2018) did not have a single domain judged as low risk of bias for the outcome of this review, demonstrating some concerns for randomization, deviations from intended interventions, measurement of the outcome and selection of pre-reported results, while also presenting high risk of bias concerning missing outcome data (Figure 2 and 3). Overall, the risk of bias assessment reveals that while two studies are methodologically sound with a low risk of bias, the majority of the included studies (five out of seven) present significant concerns. These concerns range from high risk in outcome measurement and missing data to unclear randomization processes and deviations from intended interventions, exemplified by the study of Krusche et al. (2018), which showed widespread issues across multiple domains.

Meta-analysis

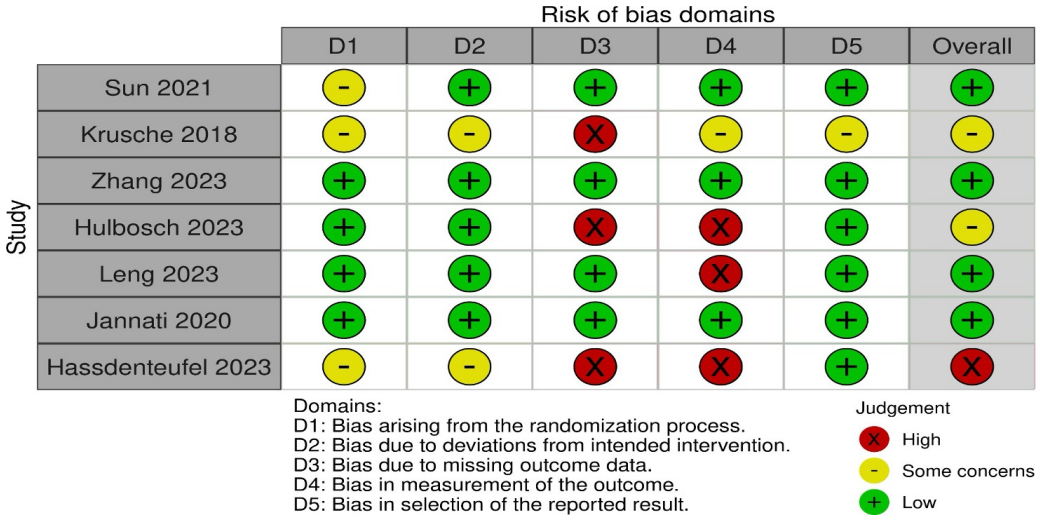

Figure 2: *Risk of bias assessment regarding the primary outcome (EPDS scores) by individual.*

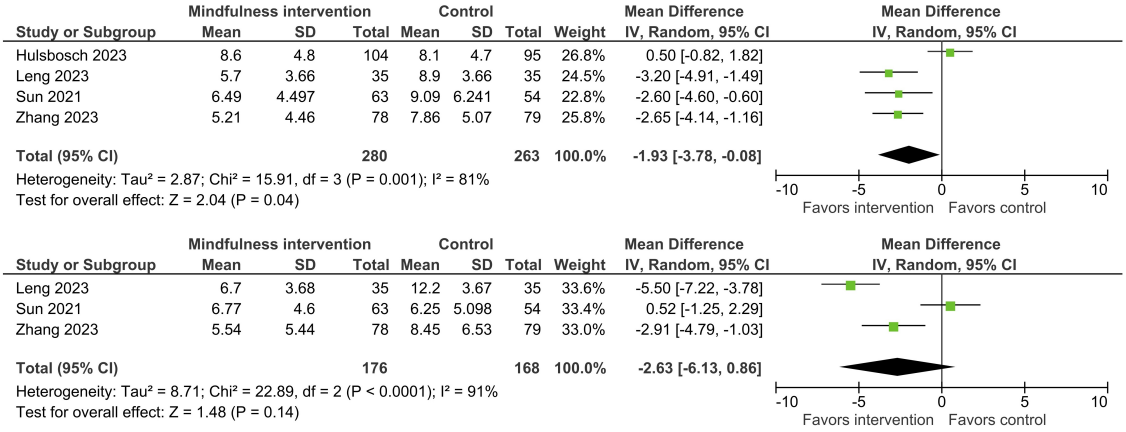

Figure 3: *Forest plot of mean differences of EPDS at post-intervention (A) and last follow-up (B).*

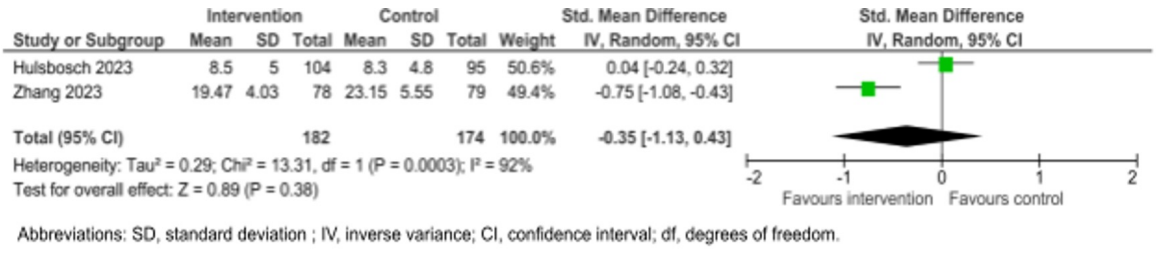

Figure 4: *Forest plot of standardized mean difference of pregnancy-related anxiety at post-intervention.*

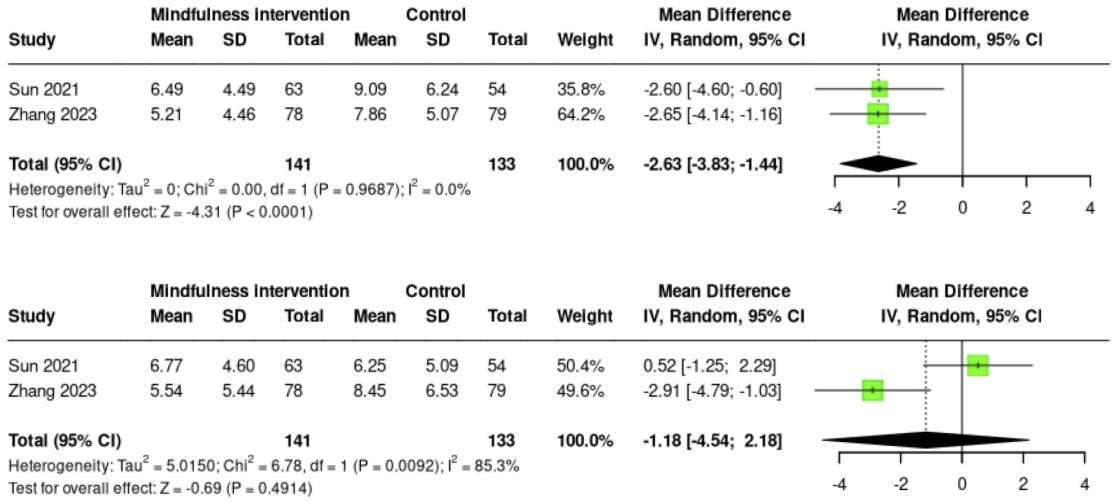

Figure 5: *Sensitivity analyses including only studies without high risk of bias in any domain: Forest plot of standardized mean difference of EPDS at post-intervention (A) and last follow-up (B).*

A meta-analysis was conducted on the reduction of EPDS scores immediately post-intervention (Figure 4). Only the studies that reported means and standard deviations or standard errors for both groups at every time point starting during pregnancy were included in the analysis. Four studies (Hulsbosch et al., 2023; Leng et al., 2023; Zhang et al., 2023; Sun et al., 2021) were analyzed, with a total of 280 participants in the intervention group and 263 participants in the control group.

Based on the analysis performed in Cochrane's RevMan using a random effects model with inverse variance method to compare the mean difference, there was a statistical difference between the two groups. The summarized mean difference was −1.93 with a 95% confidence interval of −3.78 to −0.08. Additionally, the test for overall effect showed a significant effect (Z = 2.04, p = 0.04). However, significant heterogeneity was detected (p<0.01), suggesting inconsistent effects in magnitude and/or direction. The I^2 value indicates that 81% of the variability among studies arises from heterogeneity rather than random chance.

Three of the seven studies Leng et al. (2023), Sun et al. (2021) and Zhang et al. (2023) extended their follow-up for at least one month in the postpartum period. A second meta-analysis thus was conducted for the persistence of the effects through postpartum period, based on the last follow-up, with a total of 176 participants in the intervention group and 168 participants in the control group (Figure 5). There was no statistical difference between the two groups, the summarized mean difference was −2.63 with a 95% confidence interval of −6.13 to 0.86 and non-significant test for overall effect (p = 0.14). Similarly to the analysis of post-intervention scores, significant heterogeneity was detected (p<0.01), suggesting inconsistent effects in magnitude and/or direction. The I^2 value in this case indicates that 91% of the variability among studies arises from heterogeneity rather than random chance.

Sensitivity analyses were additionally carried out to examine the consistency of the results when only including the studies which were deemed as low risk of bias in all domains according to RoB2, Sun et al., 2021 and Zhang et al., 2023. Similar results in direction and magnitude to those of the main analysis were obtained (Figure 5).

Discussion

This systematic review and meta-analysis includes seven randomized clinical trials, and investigates the effectiveness of mindfulness interventions delivered through mobile applications or other remote methods in reducing depressive symptoms during the pregnancy and postpartum period. The results suggest that remote, electronically delivered mindfulness methods could effectively reduce depressive symptoms during pregnancy and the postpartum period. This analysis corroborates the findings of Miura et al. (2023) and Zhao et al. (2021).

It included individuals from a wide range of ethnic backgrounds, mostly married women with both educational levels and economic status ranging from low to high. In general, the risk of bias was mostly observed due to missing outcome data, and outcome measurement, with a particular concern for possible

informative censoring and selection bias, as some participants, who were depressed, may not have completed follow-up.

The mindfulness interventions generally show a favorable effect on pregnancy and PPD symptoms. The effectiveness of the interventions varies across different time points, with some studies showing stronger effects than others, contributing to the overall heterogeneity, as suggested by this meta-analysis. Prior to the intervention, the baseline levels of depressive symptoms are comparable between the two groups.

Overall, while mindfulness interventions showed some immediate benefits, their long-term effectiveness on depressive symptoms during pregnancy remains inconclusive. Regarding stress levels, mindfulness interventions also appear beneficial, although the degree of effectiveness may vary depending on the specific time point. While mindfulness interventions show potential for reducing anxiety levels at certain time points, the overall evidence is not consistently supportive.

Despite the above-mentioned observations regarding effects of electronic-delivered mindfulness methods on reducing depressive symptoms during pregnancy and the postpartum period, it is important to highlight that confidence intervals were wide, which does not support definite conclusions.

This study had limitations, one of which was the heterogeneity in intervention designs and the time points used across studies. Additionally, it is important to note that there is no formal definition of mindfulness or clear distinction between it and cognitive behavioral therapy, which can lead to a lack of consensus. Moreover, although a broad search strategy was used, "mobile health (m-health)" and "depressive symptoms" were not included as search terms, which may have led to the exclusion of relevant articles, even though "mobile-based" was included. Studies involving women who had previously used mindfulness interventions were not considered; however, the study by Hulsbosch et al. (2023), which was included in this meta-analysis, did not specify whether participants had prior experience with or familiarity with these interventions. Furthermore, only two databases, PubMed and Cochrane, were used, which limited the pool of studies due to the restricted selection of databases.

Further research is needed to establish if mindfulness interventions can help pregnant and postpartum women improve their mental health, especially if this intervention can last beyond the postpartum period (long-term effect) and help women in caregiving or maternal functioning. It is also important to further explore the different types of mindfulness interventions and the needed exposure period to reproduce the desired effect.

The studies were conducted on a small group of patients, primarily from a primarily from a predominantly married population, as previously mentioned. Given that a lack of social support can be a predisposing factor for PPD, the reviewed studies may not be representative of the highest-risk population. Therefore, a multicenter study with a larger patient sample is recommended to obtain more robust results. If shown to be effective, this approach could be implemented as part of integrative medicine in the management and reduction of PPD.

Conclusion

This systematic review and meta-analysis examined the effectiveness of mindfulness interventions delivered through mHealth applications in reducing depressive symptoms during pregnancy and the postpartum period. The findings suggest that these interventions have the potential to reduce depressive symptoms, as evidenced by a reduction in EPDS scores immediately after intervention. However, it remains unclear if these benefits extend into the postpartum period over the long term. The analysis also highlighted substantial heterogeneity among studies, likely due to differences in intervention types, durations, frequencies, and participant demographics.

Despite these variations, the overall findings suggest that mindfulness interventions via mobile health applications have the potential to support mental health among pregnant and postpartum women. Further research is necessary to establish the sustained effectiveness of these interventions, to determine the most effective combinations, durations, and frequencies, and to better understand their role in perinatal care.

In summary, mindfulness interventions through mHealth applications may offer a valuable tool for reducing depressive symptoms during the perinatal period. If shown to be effective in the long term, these interventions could complement traditional perinatal care, ultimately enhancing the mental well-being of mothers and their children.

Acknowledgment

We would like to express our gratitude to the PPCR Program of Harvard T.H. Chan School of Public Health for their invaluable support and guidance, especially Professor Felipe Fregni and Dr. Alma Sanchez, whose encouragement and dedication have made this journey remarkable from day one. Special thanks to all the teaching assistants, whose assistance was crucial in completing this review, in particular Dr. Daniela Alvarado, whose commitment as a senior

teaching assistant, helped us navigate every office hour session with the confidence we needed.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

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