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Review article

Contributions of mindfulness in high-risk pregnancy: a mixed methods systematic review

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ABSTRACT

Introduction: Experiencing a high-risk pregnancy entails pathological situations with repercussions that can interfere with maternal-fetal well-being and increase maternal anxiety. Mindfulness emerges as one of the techniques used to improve the quality of care in the transition period resulting from pregnancy, which, through meditative practice, seeks to understand observation and the nature of the lived experience, resulting in a progressive state of clarity and awareness.

Objective: This review assessed the contributions of applying mindfulness in high-risk pregnancies. The review considered experimental, quasi-experimental studies, randomized controlled trials and non-randomized controlled trials. Observational studies were also considered. Evidence published in the last 5 years was considered.

Methods: This systematic review was conducted in accordance with the Joanna Briggs Institute methodology for systematic reviews of mixed methods using a convergent integrated approach to synthesis and integration. We searched for published and unpublished English, Portuguese and Spanish-language studies and grey literature. CINAHL Ultimate, MEDLINE (via Pubmed), Web of Science, Academic Search Complete, EBSCO Host Open Dissertations and Open Access Theses and Dissertations were searched in April–May 2024. Two authors screened titles and abstracts before full-text screening and data extraction. Two authors reviewed the extracted data.

Results: Ten articles were included in the review: 5 randomized controlled trials, 3 quasi-experimental studies and 2 mixed-methods studies. 9 studies measured the effectiveness of the application of mindfulness-based interventions on high-risk pregnant women and 1 assessed the acceptance of mindfulness intervention. Six studies measured the effects of the application of mindfulness in high-risk pregnant women in depressive symptoms, two reported the outcomes in stress, five on anxiety, two on psychological well-being, one on gestational weight gain, one in prenatal attachment and another in sleep quality.

Conclusions: Long term reduction of depressive symptoms, anxiety and stress and increased psychological well-being are contributions of mindfulness on high-risk pregnant women. The existing

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evidence on other contributions of the application of mindfulness is limited, further research being necessary.

1. Introduction

Pregnancy is a biological and special event, and all its phases are denoted by singularity. However, in recent decades, reproductive patterns have changed, with special relevance to maternal age, with an increase in fertility in the age group between 30 and 40 years old [1]. From the age of 35 onwards, we are faced with pregnancy at an advanced maternal age, due to the decline in fertility and the increased incidence of fetal genetic alterations [2], as well as the increased maternal incidence of kidney, autoimmune, cardiovascular and metabolic diseases, and repercussions that interfere with maternal and fetal well-being, being associated with risk situations [1,3].

A high-risk pregnancy is defined as one that is associated with a higher incidence of adverse outcomes, both for the mother and the foetus, than in the general population [4], due to the existence of psychosocial or biomedical risk factors [5]. A pregnancy can be considered high-risk owing to health problems prior to pregnancy [5,6], such as hypertension, diabetes, depression, acquired immunodeficiency syndrome, or obesity; due to conditions associated with the pregnancy itself, such as multiple pregnancies, or maternal age (either teenage pregnancy or advanced maternal age pregnancy). On the other hand, there are pregnancies that become high-risk as they progress [5,6], due to the diagnosis of associated pathologies, such as gestational diabetes, intrauterine growth restriction, pregnancy-induced hypertension or pre-eclampsia [7].

All these factors change the way pregnant women experience the transition to motherhood, as being pregnant means facing many changes at a biological, psychological and social level, which involve individual, interpersonal and relational adjustments, which can lead to anxiety, anguish and conflicts [8]. When the transition to motherhood is associated with a diagnosis of high-risk pregnancy, there is a higher prevalence of psychopathological symptoms (such as anxiety, depression and stress), decreased coping skills and sense of well-being [9].

Providing care for women diagnosed with a high-risk pregnancy becomes complex, due to the clinical condition that dictates the risk diagnosis, to the woman's psychological well-being and to the fetal well-being [10]. Multidisciplinary approach is therefore necessary and essential, particularly from a nurse specializing in maternal and obstetric health nursing [8], who must be aware of the increased challenges associated with the diagnosis of a high-risk pregnancy, promoting well-being and the development of coping strategies [9].

With the purpose of reducing anxiety, relieving stress and controlling pain, the World Health Organization recommends the use of relaxation techniques as first-line interventions to promote well-being during pregnancy [11]. Mindfulness is one of the techniques used as a strategy to improve the quality of care in the transition period resulting from pregnancy. It is based on a meditative practice, without any type of judgment, in which full attention to thoughts, emotions, sensations, body posture and acceptance of the experience is experienced, translated as the mind not forgetting in relation to the object, being its function the non-distraction [12,13]. The goal of mindfulness steams from the search for knowledge and seeks to understand observation and the nature of the lived experience, resulting in mental confusion being replaced by a progressive state of clarity and awareness [14].

There are physical, psychological and behavioural benefits associated with the practice of mindfulness during pregnancy [15], such as stress reduction, anxiety and depression [16–20] and consequent improvement in perinatal mental health [15]; promotion of the mother/foetus bond, resulting in greater mother availability for the baby's needs in postpartum [18], with also the reduction of fear of childbirth being referred as a benefit [15].

The benefits of practicing mindfulness during pregnancy are mostly psychological, but promoting pregnant women's mental health is essential for promoting a successful transition to motherhood [21].

Notwithstanding the existence of studies about mental health during pregnancy and its repercussions on the well-being of pregnant women, there is still a gap in the discussion of the application of mindfulness in high-risk pregnancies, so the review of the topic becomes fundamental.

Therefore, the objective of this review is to identify the contributions of the application of mindfulness in high-risk pregnant women.

A preliminary search was carried out in January 2024 in the JBI and Cochrane Database of Systematic Reviews databases, with no systematic reviews (SR) on the topic identified to date.

2. Methods

According to the Joanna Briggs Institute (JBI) guidelines [22], the acronym PICo was used to formulate the review question: What are the contributions of applying mindfulness in high-risk pregnancies?

Since the contributions of mindfulness practice in high-risk pregnancies can be identified through the pregnant woman's lived experience, as well as by measuring effectiveness through the application of anxiety or depression scales (for example), the review question can be answered through qualitative and quantitative studies. hence, a systematic review of mixed methods was carried out. The SR was conducted accordingly with the JBI methodology for systematic reviews of mixed methods using a convergent integrated approach to synthesis and integration [22]. This review is registered in PROSPERO (PROSPERO CRD42025637992).

2.1. Inclusion criteria

- Population (P): Studies that included high-risk pregnant women were considered.
- Phenomena of interest (I): Studies on the application of mindfulness were considered.
- Context (Co): Healthcare practice environments.

2.1.1. Types of studies

The review considered experimental, quasi-experimental studies, randomized controlled trials, non-randomized controlled trials, observational, mixed-methods and qualitative studies.

- Evidence published in the last 5 years was considered.
- Evidence published in English, French, Spanish and Portuguese was considered.

2.2. Exclusion criteria

- Studies that had as a population only pregnant women, and not high-risk pregnant women were excluded.
- Studies with a phenomena of interest other than mindfulness were excluded.
- Studies in which mindfulness was not measured/assessed were excluded.

2.2.1. Search strategy

A three-step search strategy was utilized in this review. First an initial limited search of Medline, CINAHL Complete, Web of Science and Scopus to identify studies on the topic, followed by analysis of the text words contained in the title and abstract and the index terms used to describe the articles. The keywords pregnant, mindfulness and high-risk pregnancy were identified. The search strategy, including all identified keywords and index terms was adapted for each included information source and a second search was undertaken in April–May 2024. The full search strategies for every information source searched are provided in Appendix I. Finally, the reference list of all studies selected for critical appraisal was screened for additional studies.

2.2.2. Information sources

The databases that were searched included: CINAHL Ultimate, and Web of Science, accessed through EbscoHost, as well as Medline (via Pubmed), Academic Search Complete, MedicLatina, EBSCO Host Open Dissertations and Open Access Theses and Dissertations.

2.2.3. Study selection

Following the search, all identified citations were collated and uploaded into Endnote Web (Clarivate Analytics, PA USA) and duplicates removed. Titles and abstracts were then screened by two reviewers (ID & SS) for assessment against the inclusion criteria of the review. Studies that met the inclusion criteria were retrieved and assessed in full against the inclusion criteria. Full text studies that did not meet the inclusion criteria were excluded and reasons for exclusion are provided in Appendix II. Any disagreements that arose between the reviewers were resolved through discussion.

2.2.4. Assessment of methodological quality

Eligible studies were critically appraised by two reviewers (ID & SS) for methodological quality. Quantitative studies (and quantitative component of mixed methods studies) as well as qualitative studies (and qualitative component of mixed methods studies) selected for retrieval were assessed for methodological validity prior to inclusion in the review, using the standardized JBI critical appraisal instruments [22]. Any disagreements that arose between the reviewers were resolved through a third reviewer.

2.2.5. Data extraction

Quantitative and qualitative data were extracted from included studies by two reviewers (ID & SS) using a tool adapted by the authors through the JBI Mixed Methods Data Extraction Form [22]., which is available in appendix III. The extracted data included specific details about the population, location of the study, study methods, intervention of the study and outcomes of relevance to the review question. Any disagreements that arose between the reviewers were resolved through discussion.

2.2.6. Data transformation

The quantitative data from experimental and observational studies (including the quantitative component of mixed methods studies) was transformed into textual descriptions and narrative interpretation, in a way that answered the review question.

2.2.7. Data synthesis and integration

The heterogenicity of the included studies did not allow a meta-analysis to be carried out, therefore, a meta-aggregation was conducted, accordingly with the JBI guidelines [22]. Regarding the qualitative studies and the qualitative data from the mixed methods studies, a meta-synthesis was carried out, allowing the explanation of the phenomenon under review [23]. Extracted data were categorized and pooled together based on similarity in meaning to produce a set of integrated findings.

3. Results

3.1. Study inclusion

154 studies were identified (23 on Medline (via Pubmed), 3 on Academic Search Complete, 36 on Web Of Science, 1 on CINAHL Ultimate, 0 on MedicLatina; 29 on EBSCO Host Open Dissertations; 61 on Open Access Theses and Dissertations). Following the search, all identified citations were collated and uploaded into Endnote Web (Clarivate Analytics, PA USA), and 40 duplicate articles were removed.

After the screening of the titles and abstracts, 95 studies were excluded, leaving a total of 19 studies. The full texts of the 19 studies citations assessed in detail against the inclusion criteria by 2 reviewers (ID & SS) and 9 studies were excluded. Reasons for exclusion of full-text studies that did not meet the inclusion criteria are reported in Appendix II, being the most frequent the population not being high-risk pregnant women, and the non-evaluation of the mindfulness intervention. One article was removed because it was only available in Indonesian and there was no response from the author. The research results are reported in full and presented in the form of a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram [24] in Fig. 1.

3.2. Methodological quality

Five studies are of the randomized clinical trial type [25–29] (Table 1), two are mixed methods studies with a qualitative component [30,31] (assessed in Table 2), along with a randomized clinical trial [30] (Table 1), and another with an analytical cross-sectional study [31] (Table 3). 3 are quasi-experimental studies [32–34] (Table 4).

Even though none of the included studies met all quality criteria according to the JBI critical appraisal tools [22], for they exhibited several methodological limitations that could impact their validity and reliability, none of the included studies were excluded.

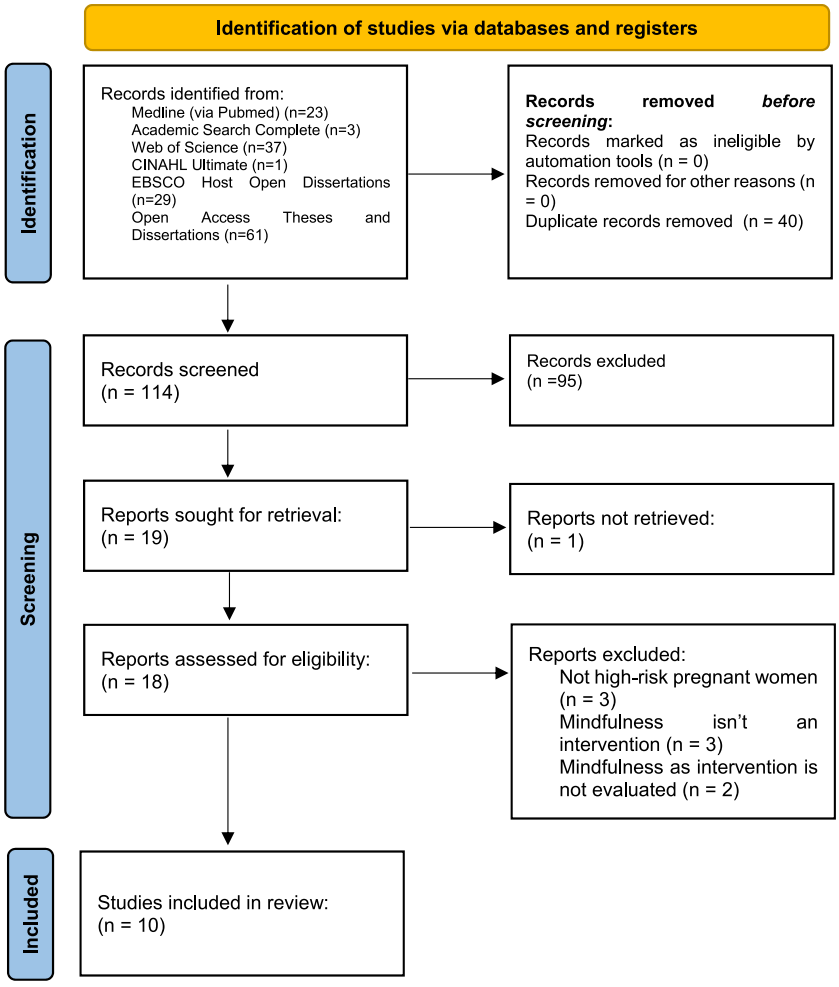

Fig. 1. Search results and study selection and inclusion process [24].

Table 1
Critical Appraisal of included randomized controlled trials.

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
[25]	Y	N	Y	N	N	Y	N	Y	Y	U	UN	Y	Y
[26]	Y	N	Y	N	N	N	Y	Y	Y	Y	N	Y	Y
[27]	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y
[28]	N	N	N	Y	N	N	Y	Y	Y	Y	U	Y	Y
[30]	N	N	Y	N	N	Y	N	Y	Y	U	Y	Y	Y
Zemestani & Nikoo, 2019	Y	Y	Y	N	U	Y	UN	Y	Y	Y	Y	Y	Y

Y, yes; N, no; U, unclear; JBI critical appraisal checklist for randomized controlled trials.
Q1: Was true randomization used for assignment of participants to treatment groups?
Q2: Was allocation to treatment groups concealed?
Q3: Were treatment groups similar at the baseline?
Q4: Were participants blind to treatment assignment?
Q5: Were those delivering treatment blind to treatment assignment?
Q6: Were outcomes assessors blind to treatment assignment?
Q7: Were treatment groups treated identically other than the intervention of interest?
Q8: Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analyzed?
Q9: Were participants analyzed in the groups to which they were randomized?
Q10: Were outcomes measured in the same way for treatment groups?
Q11: Were outcomes measured in a reliable way?
Q12: Was appropriate statistical analysis used?
Q13: Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

Table 2
Critical appraisal of included qualitative studies.

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
[30]	Y	Y	Y	Y	Y	U	N	Y	Y	Y
[31]	Y	Y	Y	Y	Y	N	N	Y	Y	Y

Y, yes; N, no; U, unclear; JBI critical appraisal checklist for qualitative studies.
Q1: Is there congruity between the stated philosophical perspective and the research methodology?
Q2: Is there congruity between the research methodology and the research question or objectives?
Q3: Is there congruity between the research methodology and the methods used to collect data?
Q4: Is there congruity between the research methodology and the representation and analysis of data?
Q5: Is there congruity between the research methodology and the interpretation of results?
Q6: Is there a statement locating the researcher culturally or theoretically?
Q7: Is the influence of the researcher on the research, and vice-versa, addressed?
Q8: Are participants, and their voices, adequately represented?
Q9: Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?
Q10: Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?

Table 3
Critical appraisal of included analytical cross-sectional studies.

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Schiele et al. ,2022	Y	Y	U	Y	N	N	Y	U

Y, yes; N, no; U, unclear; JBI critical appraisal checklist for analytical cross sectional studies.
Q1: Were the criteria for inclusion in the sample clearly defined?
Q2: Were the study subjects and the setting described in detail?
Q3: Was the exposure measured in a valid and reliable way?
Q4: Were objective, standard criteria used for measurement of the condition?
Q5: Were confounding factors identified?
Q6: Were strategies to deal with confounding factors stated?
Q7: Were the outcomes measured in a valid and reliable way?
Q8: Was appropriate statistical analysis used?

Common issues included insufficient reporting of methodological processes, such as the lack of details on randomization and allocation concealment [28]. One study [31], failed to adequately control for confounding variables, and another [32] did not provide comprehensive details about control conditions. Measurement validity and reliability were also concerns, with inconsistent application of standardized tools across participants and time points [33]. Participant selection and allocation biases were frequent, with true

Table 4
Critical appraisal of included quasi-experimental studies.

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
[32]	Y	Y	Y	Y	Y	Y	Y	Y	Y
[33]	Y	N	U	NA	Y	Y	Y	U	Y
[34]	Y	N	N	Y	Y	Y	Y	N	Y

Y, yes; N, no; U, unclear; JBI critical appraisal checklist for quasi-experimental studies.
Q1: Is it clear in the study what is the "cause" and what is the "effect" (ie, there is no confusion about which variable comes first)?
Q2: Were the participants included in any comparisons similar?
Q3: Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
Q4: Was there a control group?
Q5: Were there multiple measurements of the outcome both pre and post the intervention/exposure?
Q6: Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analyzed?
Q7: Were the outcomes of participants included in any comparisons measured in the same way?
Q8: Were outcomes measured in a reliable way?
Q9: Was appropriate statistical analysis used?

randomization and allocation concealment often inconsistently applied or reported. Specifically, one study [34] lacked a control group, had incomplete follow-up information, and did not adequately describe the operationalization of validated tools, limiting the ability to attribute observed effects solely to the intervention and hindering replication efforts.

It should also be noted that there was a certain discrepancy in the sample sizes of the studies included, and the remainder showing a large dispersion within this range.

3.3. Characteristics of included studies

Studies were published between 2020 and 2024. Four studies were based in the United States [27,30,32,33], two in Germany [31, 34], one in China [28], one in Iran [29], one in Spain [26] and one in Turkey [25]. Five studies are of the randomized clinical trials [25–29], two are mixed methods studies [30,31] and 3 are quasi-experimental studies [32–34].

Three studies recruited high-risk pregnant women [25,31,34], being two of them with hospitalized pregnant women [31,34]. Three studies recruited pregnant women with perinatal depression (Edinburgh Postnatal Depression Scale (EPDS) score >9 or meeting Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria for depression and anxiety disorders) [28,29,33]. Two studies recruited pregnant women overweight/obesity (BMI >25 kg/m^2) [27,32]. One study recruited pregnant women with high-risk of developing intrauterine growth restriction [26] and another recruited pregnant woman with a history of a hypertensive disorder and at risk for hypertensive disorders in pregnancy [30].

One study aimed to determine the acceptance of a brief electronic mindfulness-based intervention [31]. Eight studies aimed to assess the effectivity of mindfulness-based cognitive behavioural intervention in symptoms of perinatal depression, anxiety and stress [25–29,32–34], with one of them wanting also to evaluate the effectiveness on prenatal attachment levels [25]. Another evaluated the effectiveness of a mindful based intervention on perceived stress, eating behaviours, and gestational weight gain [32]. One study aimed to explore the effects of mindfulness intervention on sleep quality [30]. An overview of the characteristics of completed studies is provided in Appendix IV.

3.4. Findings of the review

The ten studies that were included in this SR reported the effects of a mindfulness-based intervention, with four of them being delivered electronically (smartphone-based) [28,30,31,34] and in the other six, the intervention was applied in groups or individually through certified professionals [25–27,29,32,33]. Six studies measured the effects of the application of mindfulness in high-risk pregnant women in depressive symptoms [27–29,32–34], two reported the outcomes in stress [25,32], five on anxiety [25,26,29, 32,34], two on psychological well-being [26,29], one on gestational weight gain [32], one in prenatal attachment [25], one in sleep quality [30], and another reported the acceptance of the mindfulness-based intervention [31]. The overview of results of included studies is presented in Table 5.

4. Discussion

The aim of this SR was to determine the contributions of the application of mindfulness in high-risk pregnancies. Ten studies were considered eligible to be included in the review. Of the six studies that measured the effects of the application of mindfulness in pregnant women with depression, five of them revealed improvements in depressive symptoms [27–29,32,33], that remained low in longitudinal assessments [27–29,33]. Depression affects about 12–18 % of pregnant women, being twice as frequent in pregnant women hospitalized due to pregnancy complications [35]. The effects of mindfulness-based interventions on improving depressive symptoms in healthy pregnant women is well known [36] and the results of this review show that there are also benefits in high-risk pregnant women, that is, those who had severe depressive symptoms in the perinatal period. Mindfulness interventions have long-term mediating effects in depressive symptoms, which is in line with the results of studies carried out on healthy pregnant women [36,37].

Table 5
Overview of results of included studies.

Citation	Study design	Intervention	Intervention frequency/length	Intervention target	Outcome measure	Control	Outcome
[25]	RCT	Mindfulness-Based Stress Reduction program	8 sessions: 2 sessions per week for 1 month	Groups of high-risk pregnant women	Prenatal Distress Questionnaire-Revised (NuPDQ); Pregnancy-Related Anxiety Questionnaire-Revised 2 (PRAQR2); Prenatal Attachment Inventory (PAI)	No intervention	The PRAQR2, significantly decreased in IG when compared to the CG; The PAI score increased significantly in the IG, when compared to the CG; There was no statistically significant difference in the NuPDQ total mean score between the 2 groups.
[26]	RCT	Mediterranean diet (MD) or mindfulness-based stress reduction (MBSR)	MD: 2 h monthly of individual and group educational sessions MBSR: 2.5-h weekly sessions and 1 full-day session for 8 weeks	Groups of pregnant women at high-risk for small for gestational age (SGA)	% of newborns who were SGA at birth; % of newborns with adverse perinatal outcome; STAI (State-Trait Anxiety Inventory); WHO Five Well Being Index score; Five Facet Mindfulness Questionnaire (FFMQ)	TAU	In the MBSR group, 15.6 % of newborns were found to have light birth weight for their gestational age, whereas in the Mediterranean diet group this was found in 14 % of pregnancies and 21.9 % in the CG; The composite adverse perinatal outcome was found to be 26.2 % in the CG, 18.6 % in the MD and 19.5 % in the MBSR; In the MBSR there was lower STAI scores and higher WHO Five Well Being Index score and FFMQ, when compared with the CG
[27]	RCT and a longitudinal observational study	mindfulness-based intervention	2-h weekly sessions for 8 weeks	Groups of Overweight or obese pregnant women	Patient Health Questionnaire (PHQ-9)	TAU	The PHQ score decreased from baseline over 8 years in both groups, but in the IG was more pronounced; In the CG there was a greater probability of developing moderate or more intense depressive symptoms In the IG fewer depressive symptoms were reported at each annual assessment
[28]	RCT	smartphone-based mindfulness training intervention	8 sessions of 25-min for 8 weeks	Pregnant women who attended an obstetrics clinic of a hospital in China	EPDS	8-week regular WeChat health consultations	The EPDS score decreased and remained at a low level; In the IG there was a probability of 2.471 of a decrease in their EPDS score compared to their reference score 60.9 % reduction in the risk of developing depressive symptoms.
[30]	RCT and semi structured interview	Phone-delivered mindfulness training (MT)	weekly individual 30-min sessions for 8 weeks	Pregnant women with a history of a hypertensive disorder and at risk for hypertensive disorders in pregnancy	Pittsburgh Sleep Quality Index (PSQI) Sleep changes over pregnancy	TAU	In the IG there was less daytime dysfunction; There were no other significant group differences in sleep parameters; both groups reported sleep disturbances; In the IG, the MT produced an improvement in the ability to fall asleep and return to sleep after waking up In half of the IG, the MT produced an improvement in sleep quality.

[29]	RCT	Mindfulness-based cognitive therapy	Two hours weekly sessions for 8 weeks	Groups of pregnant women with comorbid depression and anxiety	Beck Depression Inventory-II (BDI-II) Beck Anxiety Inventory (BAI); Emotion Regulation Questionnaire; Scales of Psychological Wellbeing (SPWB)	No intervention	Decrease in the BDI-II and BAI scores, remaining low post-intervention and follow-up; improvement in emotional regulation strategies in the post-intervention and follow-up, as well as an increase in levels of cognitive reappraisal. decrease in levels of expressive suppression in the post-intervention and follow-up; increase in SPWB score, which remained high throughout the follow-up.
[31]	Exploratory pilot study	electronic mindfulness based intervention (eMBI)	three 45-min modules for 1 week	30 hospitalized high-risk pregnant women	Acceptance and experiences of the eMBI	Not applicable	83 % of the participants of eMBI were motivated to continue with the program and recommend it; In 70 % of the participants, the eMBI produced a confrontation with their fears and anxieties; In 37 % of the participants, the eMBI promoted relaxation and promoted the acquisition of stress coping strategies.
[32]	Quasi-Experimental trial	mindfulness training with a focus on healthy eating and weight gain during pregnancy	2 h weekly classes for 8 weeks	Groups of pregnant women of low income with overweight/obesity	Gestational weight gain; Cohen's Perceived Stress Scale; Patient Health Questionnaire (PHQ-9); Pregnancy-Related Anxiety Scale; Dutch Eating Behaviour Questionnaire; Yale Food Addiction Scale	Treatment as usual (TAU)	Most women in the sample gained excessive weight during pregnancy (68 % on average across groups), with no differences between IG or CG; The IG showed significant decreases in perceived stress and depression, and in eating-related behaviours (food addiction, emotional eating, external eating); There were also improvements in acceptance of negative experiences; There were no statistically significant improvements on any measures in the CG, except in food addiction.
[33]	Quasi-experimental Observational study	mindfulness-based cognitive behavioural intervention	8 weeks	Groups of 4–6 pregnant or postpartum women	EPDS - Edinburgh Postnatal Depression Scale	Not applicable	In the symptomatic women there was a decrease in the EPDS score that remained at the 2-month follow-up; In asymptomatic women, there was no significant change in their EPDS score.
[34]	Quasi experimental Prospective observational study	Electronic mindfulness based intervention (eMBI)	three 45-min modules for 1 week	Hospitalized high-risk pregnant women	EPDS STAI-S - State-Trait Anxiety Inventory; PRAQ-R - Pregnancy-Related Anxiety Questionnaire	Not applicable	No significant change was found in the EPDS, STAI-T, or PRAQ-R scores Participants who completed >50 % of all the modules of the intervention, had lower PRAQ-R scores Reduction in the mean score of STAI-S

RCT – randomized controlled trial; EPDS - Edinburgh Postnatal Depression Scale; IG – intervention group; CG – control group; TAU – treatment as usual; MT – mindfulness training.

Five studies measured the effects of applying mindfulness on anxiety, demonstrating a reduction in anxiety [25,26,29,32,34], being more significant the higher the intervention completion rate [25]. The prevalence of prenatal anxiety symptoms across the three trimesters is 22.9 % [38], being a common mental health problem among pregnant women, and even more frequent in hospitalized pregnant women [35]. Reducing anxiety is one of the well-known benefits of mindfulness interventions, not only in pregnant women [36,37], but in the general population.

Regarding the influence of mindfulness on stress, one study demonstrated no statistically significant reduction [25], and another demonstrated significant decreases in perceived stress [27]. It was also referred, as an effect of the application of mindfulness, the

acquisition of stress coping strategies [32]. The effects of mindfulness interventions on stress of healthy pregnant women are known [37] however, in high-risk pregnant women, the existing evidence is still insufficient.

Stress, depression and anxiety in pregnant women have direct effects in their foetus, such as changes in heart rate, movements and sleep pattern, and constitutes a risk for the later child development, increasing the risk of developmental and psychiatric disorders [39].

Two studies reported effects on psychological well-being [26,29], which increased after the application of mindfulness intervention, remaining high in longitudinal assessments [29].

Regarding gestational weight gain, no effect was detected after the application of mindfulness [32].

One study measured the influence of the application of mindfulness in prenatal attachment [25], which increased significantly. The promotion of the mother/foetus bond is one of the known benefits of applying mindfulness to pregnant women [20], being also significant in high-risk pregnant women.

One study assessed the influence of applying mindfulness on sleep quality, being reported less daytime sleep dysfunction, but no other significant effects in other sleep parameters [30]. On the other hand, it was referred improvements in the ability to fall asleep and return to sleep after waking up through the skills acquired through mindfulness.

Regarding the effects of mindfulness interventions on prenatal attachment and sleep quality in high-risk pregnant women the available evidence is weak, due to the limited number of available studies, indicating that further research is necessary, especially qualitative studies that allows the comprehension of the phenome in the perspective of this women [40].

5. Conclusions

There are several contributions of applying mindfulness in high-risk pregnant women, such as the reduction of depressive symptoms, maintained in longitudinal evaluations, the reduction of anxiety and stress and increased psychological well-being. However, the existing evidence on other contributions of the application of mindfulness is limited, further research being necessary.

Recommendations for practice

The application of mindfulness has several benefits for high-risk pregnant women, being relatively easy to apply, through electronic applications or through certified professionals, individually or in group sessions. It is an intervention whose evidence shows it to be risk-free, in which its application is associated with benefits or no significant effect at all, an essential factor during pregnancy, especially when compared to other psychoactive interventions used to the same benefits.

CRediT authorship contribution statement

Irina Neves Dutra: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis. **Sandra Seixinho:** Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Conceptualization. **Cristina Baixinho:** Writing – review & editing, Validation, Supervision, Project administration, Formal analysis. **Maria Helena Presado:** Writing – review & editing, Validation, Project administration, Formal analysis, Data curation, Conceptualization. **Rubén García-Fernández:** Supervision, Project administration, Data curation, Conceptualization.

Ethics declaration

Review and/or approval by an ethics committee was not needed for this study because this study did not include direct human or animal participation.

All the data from the included studies in this review were acquired in compliance with ethical and consent requirements outlined in the Ethics and policies guidelines of the Heliyon journal.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2025.e43059.

Data availability statement

All the data that support this review is included in the supplemental files.

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