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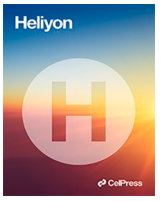

Research article

Effects of yoga on depressive symptoms in women with pregnancy: A systematic review and meta-analysis

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ABSTRACT

Background: While electroconvulsive therapy and antidepressants are standard treatments for depressed pregnant women, they are not without threats. The objective of this study was to quantitative synthesis of the literature regarding the effect of yoga interventions on depressive symptoms in pregnant women.
Methods: Nine electronic databases were searched for primary studies with pregnant women with depression measured as outcomes and written in English. Based on the random-effects model, we used Hedges' g to compute the effect size and examined the subgroup analysis.
Results: We found twelve primary studies which included 738 participants who were 28.43 ± 1.92 years old across studies. The overall effect size using random-effects model was $g = 1.120$ (95%CI .52, 1.72, $p < .001$). Providing yoga to pregnant women with mood disorder had a lesser effect size ($g = .10$) than providing yoga to pregnant women without a mood disorder ($g = 1.45$). Funded studies had a lesser ES (g = .51) than those with unfunded (g = 1.98). Proving yoga in Eastern countries had a greater ES (g = 1.82) than providing yoga in Western (g = .40). No quality indicators showed moderator effects.
Conclusion: When compared to controls, pregnant women who practiced yoga reported significantly improved depressive symptoms. Yoga might be an alternative complementary therapy that clinicians and other healthcare professionals might think about utilizing to help pregnant women who are depressed.

1. What is already known about the topic

- While electroconvulsive therapy and antidepressants are standard treatments for depressed pregnant women, they are not without threats (a negative impact on fetuses and infants).
- In complementary and alternative medicine (CAM), yoga has gained popularity as a safe, gentle, and especially beneficial type of mood therapy.
- However, the effect of yoga on depressive symptoms in pregnant women seems controversial.

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2. What this paper adds

- Yoga had a large effect on reducing depressive symptoms in pregnant women.
- Mental health status of pregnant women, funding, and country were moderators affecting effect size.

3. Introduction

Women's physical and mental health are significantly impacted throughout pregnancy [1]. Throughout pregnancy, it has been shown that elevated cortisol level linked with depression can have negative consequences on the pregnancy's outcomes and the development of the fetus [2–4]. Dadi, Miller [2] conducted an umbrella review of 306 primary studies including 877,246 individuals and found that the prevalence of antenatal depression ranged from 15 to 65 %. It's interesting to note that infants born to depressive mothers had increased odds of low birth weight and preterm birth, respectively, by 1.49 (95%CI, 1.32, 1.68) and 1.40 (95%CI, 1.16, 1.69) times [2]. Adverse biological effects have been observed in developing fetuses (such as hyperactivity and irregular heart rates), newborn infants (including altered EEG, low dopamine levels, and higher rates of premature death), and children (with increased cortisol levels and a higher likelihood of being overweight) when depression in pregnant women goes untreated [3,5].

Psychotherapy, electroconvulsive therapy (ECT), and antidepressants can be effective in treating depression; however, they come with certain risks. Researchers have identified potential negative impacts on fetuses and infants when these treatments are used. For instance, a systematic review and meta-analysis conducted by Leung and Wong [6] found that the use of antidepressants during pregnancy may increase the risk of fetal seizures by 2.3 times. Similarly, a study by Uguz [6] found gestational antidepressants associated with the risk of neonatal seizure. In addition, compared to neonates or children of mothers who did not take antidepressants during pregnancy, those whose mothers took these drugs during their pregnancies had a higher risk of preterm delivery, low birth weight, spontaneous abortion, and ADHD [7]. Moreover, when using ECT, including both bilateral and unilateral electrode placement used for depression treatment, adverse effects such as a reduction of fetal heart rate, uterine contraction, and premature labor were reported in about 30 percent of cases [8–10]. To provide the best possible outcomes for the women and the unborn baby, antidepressants and ECT should be properly administered and carried out in a multidisciplinary care environment [8,9]. Additionally, there are numerous obstacles, such as the cost of treatment, resistance to treatment due to concerns about exposing the fetus to antidepressants or a lack of interest in psychotherapy, and the stigma associated with seeking help [12,13]. Also, several clinicians are reluctant to employ antidepressants and ECT due to a lack of experience, and the extensive literature is sometimes contradictory [11]. Therefore, alternative and complementary treatment is growing, and one of these therapeutic treatments is yoga-based interventions.

For pregnant women, yoga has become a popular complementary and alternative medicine (CAM) technique because it is a safe, gentle, and very beneficial type of psychological therapy [12]. Yoga that incorporates breathing, meditation, and postures is linked to the growth of body awareness and wellness [13]. Several studies have found that yoga has several health benefits for the body, such as assisting with blood sugar regulation, treating musculoskeletal conditions, and maintaining the cardiovascular system [14]. Also, it could help increase positive feelings and decrease negative feelings and dépression [14–16].

Many researchers have reported yoga to be clinically beneficial for adult with acute and chronic health conditions [17–19] including in women with pregnancy [15,16,20]. For example, a systematic review and meta-analysis by Lin, Huang [15] found that yoga made a significant reduction in depression symptoms in pregnant women compared to a control group (SMD = −1.58, 95%CI, −2.31, −.85, p < .001, I^2 = 90 %, s = 8). However, this meta-analysis included only eight primary studies and the researchers did not examine the subgroup analysis to explore the source of the heterogeneity. Likewise, another systematic review and meta-analysis by Ng, Venkatanarayanan [16] found that yoga had a positive effect in improving depression in pregnant women (SMD = −.452, 95%CI, −.82, −.88, p = .015, s = 6). They only included six primary studies, leading to findings from these two meta-analyses that suggested yoga has positive effects on depressive symptoms in pregnant women. However, the number of primary studies included in these meta-analyses was relatively small (ranging from 6 to 8), which can introduce bias and potentially overestimate the effect size of the intervention. Importantly, a meta-analysis by Jiang, Li [21] reported that yoga is a non-significant intervention to reduce depression symptoms in women with pregnancy (SMD = .38, 95%CI, −.04, .80, I^2 = 74 % p = .07, s = 6). As the three meta-analyses above found, the effect of yoga on depressive symptoms seems controversial. Thus, the objective of this systematic review was to examine the effect of yoga on depression in women with pregnancy and explore the source of heterogeneity.

4. Methods

In order to identify, select, and critically evaluate the literature, this study was guided by the Preferred Reporting Items of Systematic Reviews and Meta-analysis (PRISMA) framework [22]. A protocol for this research was registered with PROSPERO, the International Prospective Register of Systematic Reviews (CRD42023391979).

4.1. Search strategy and selection criteria

Nine databases were systematically searched for eligible papers. A database search was performed through PubMed (1809+), CINAHL (1937+), Ovid Medline (1946+), Ovid APA (1967+), Scopus (1788+), Web of Science (1997+), Academic Search Complete (1887+), Cochrane Library (1995+), and ProQuest and Theses (1996+) from all articles retrieved up to September 23, 2024. Two researchers carried out the search independently after identifying the relevant articles from these databases. The first step was to use EndNote ×9 to identify and eliminate any duplicates among these identified articles. The remaining papers were screened for

relevancy using title and abstract, and full-text screening was used to establish which articles were relevant. Furthermore, a search was conducted for relevance in the reference list of related review papers. Disagreements were settled through discussion until an agreement was achieved. If more information was required, the primary authors of those articles were contacted. The key search terms were (yoga) AND (depress* OR depression OR depressive OR depressed OR depressive disorder) AND (pregnan* women). A helpful method to extend the search is by using asterisks, which contain the terms in many word forms. Please see Supplementary Table 1 for an example of the full search stratégies.

4.2. Inclusion and exclusion criteria

In this systematic review and meta-analysis, the PICOs framework, which includes population, intervention, comparison, outcome, and study design, was utilized. Only articles written in English were selected. For inclusion, two researchers (REDACTED) read the full texts of all the qualified abstracts. Discussion and agreement were used for resolving any disagreement.

1) *Population:* the chosen population was pregnant women
2) *Intervention*: antenatal yoga as intervention group
3) *Comparison*: standard pre-natal care, waitlist control, and routine based on gestation week
4) *Outcome measure:* quantitative depression

We excluded primary studies in which the primary researchers failed to provide us with the necessary information within two months of our request to compute the effect size, such as means and standard deviations (SDs), standard errors (SE), or confidence intervals (CIs) of depression. Trials in which yoga was combined with another intervention that affected depressed symptoms, such as social support or counselling, or trials in which there were case studies or had less than four participants in each group were also excluded. Sample sizes affect the precision of the confidence interval for the common effect size in a meta-analysis [23,24]. Moreover, studies on physical exercise that did not independently show how yoga affects depression were eliminated. Finally, we did not include case studies, through reviews, meta-analyses, or qualitative research.

4.3. Data extraction and coding

We developed a codebook to extract data from each primary study [25]. The extraction form comprised the following data: author, year of publication, funding, country, publication status, setting of conduct, comparison group, sampling design and quality indicators consisting of group assignment, concealed allocation, masked data collectors, intention-to-treat analysis, fidelity, yoga format, the duration of the yoga in weeks, the number of session per week, and the length of each session. Also, we coded participants' characteristics including the total number of the participants enrolled, their mean age and standard deviation, number of participants in each group, number of participants at analysis in both groups, and the number of dropouts. Finally, we coded outcomes including depression instruments, scale reliability, means and standard deviations of scale scores, and the effect direction [23,25].

Two researchers (CR & SP) completed the data extraction process. Any consistency issues in data extraction were addressed through discussion between two researchers and consultation with a third researcher (SO).

4.4. Statistical analysis

We calculated the standardized mean difference between the post-test depression scores for yoga and the comparison groups using Comprehensive Meta-Analysis (CMA) version 3.0 in order to determine the effect size (ES) [23]. By using the standardized mean difference, we were able to compare the impacts detected using various instrument measures. We used the random-effects model on the assumption that the real effects were normally distributed. In order to determine the mean of the distribution of true effects, CMA weight each study using the random-effects model, which results in more moderate weights than the fixed-effect models [23,26]. Importantly, we estimated the ES by using Hedges' g correction for small study samples with 95 % confidence intervals (CIs) [23].

4.5. Heterogeneity assessment

Using a visual assessment of the forest plot and the Q and I^2 statistics, we determine the degree of heterogeneity across the primary studies [23]. The overall dispersion among ESs is depicted by the Q statistic. There is a lot variability when the Q statistic is significant ($p < .05$). According to the I^2 statistic, heterogeneity is defined as the ratio of true heterogeneity to overall variation among ESs. For low, moderate, and high, respectively, an I^2 greater than 50 % indicate significant heterogeneity, whereas values of 0 % show no heterogeneity at all [23]. We applied moderator analysis for investigation out the causes of heterogeneity where it was present. For continuous moderators, we employed meta-regression, while for categorical moderators, we utilized an ANOVA analogue [23].

4.6. Assessment of methodological quality

To assess the methodological quality of studies, we used the quality indicators [25,27] as moderators and examined the differences in ESs for studies with and without the quality indicators [23,27]. We considered blinded data collection, a priori power analysis, fidelity of intervention, comparison of baseline participant characteristics, attrition rate, intention-to-treat, allocation concealment,

and fidelity of intervention as quality indicators [25,27]. They were examined as dichotomous moderators, whereas attrition rate was examined as a continuous moderator [23]. The impact of research quality may be estimated from differences in ESs between studies depending on whether a quality indicator is present or absent [23]. See Supplementary Table 3.

4.7. Estimation of bias

To quantify publication bias, three methods were used: the funnel plot, the Egger's regression test, and the Begg and Mazumdar rank correlation test. A simple scatterplot of each study effect estimate vs. Standard error is called a funnel plot. A visually unbalanced funnel plot demonstrates bias in publication. Publication bias is also shown by a significant ($p < .05$) result from the Egger regression test or the Begg and Mazumdar rank correlation test [23,28].

4.8. Ethical approval

Since the data used in the meta-analysis were collected from primary studies that had already received ethical approval, and no original raw data were utilized, this study does not require additional ethical approval or patient consent.

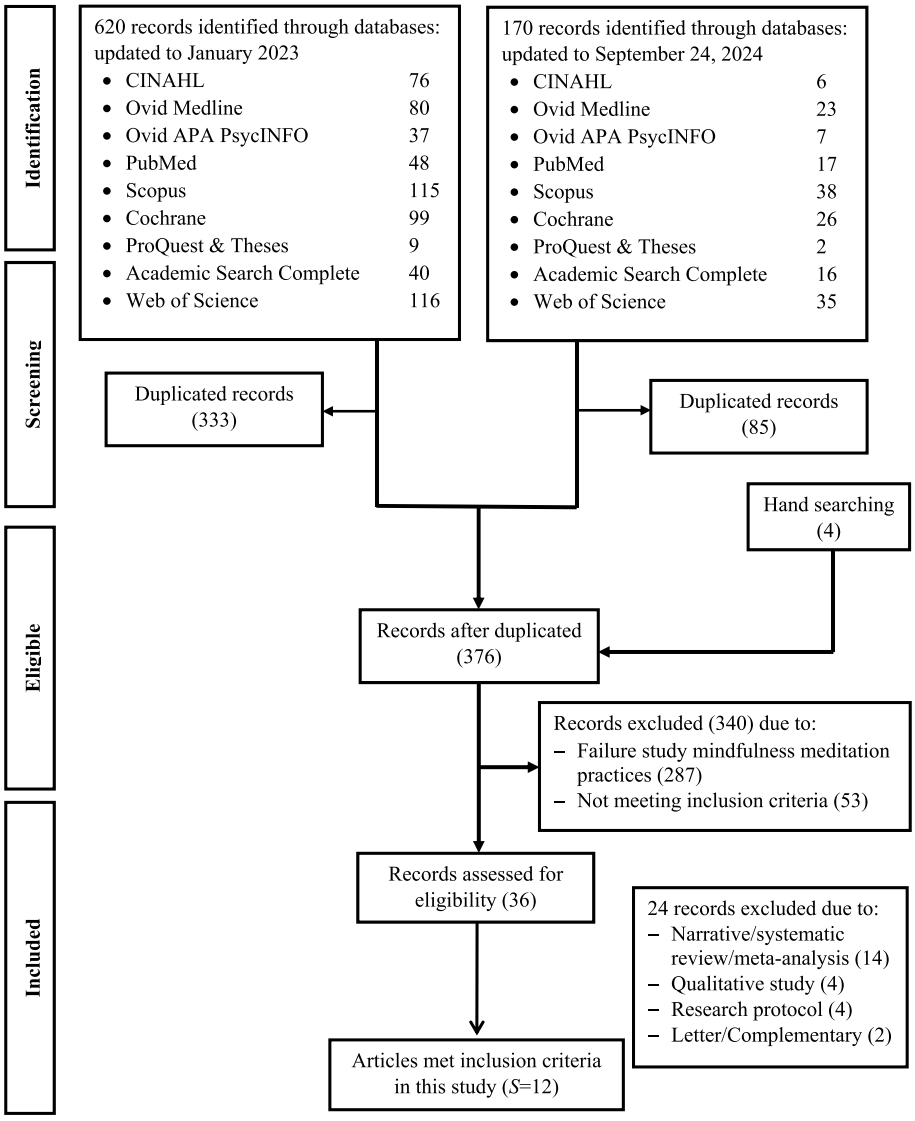

Fig. 1. Prisma flow of included primary studies.

5. Results

5.1. Demographic characteristics of included studies

After duplicates were eliminated, an initial pool of 794 articles (from electronic database searches and ancestry searches) in nine databases. Of 376 articles, 340 were excluded based on title and abstract review, resulting in 36 articles for full-text review. Twenty-four primary studies were further removed by the full-text evaluation, and the remaining twelve primary studies for the analytical set. Fig. 1 shows the PRISMA flow of primary studies.

Twelve primary studies met the inclusion criteria and were included in the analysis, encompassing data from 12 between-group comparisons and seven pre/post-test/control group comparisons. All these studies were published between 2012 and 2023. The systematic review and meta-analysis involved a total of 738 participants, with 398 individuals participating in yoga interventions and 350 serving as controls. Six of the primary studies took place in the United States [32–37], three in India [38–40], two in Indonesia [41, 42], and one in China [43]. See Supplementary Table 2. The mean age of participants ranged from 25.73 to 31.51 years (Mean 28.43 ± 1.92, $s = 10$). See Table 1.

5.2. Effects of yoga

Effect sizes (ESs) ranged from −.081 to 5.297 for comparisons between the yoga intervention and control groups (k = 12). The forest plot of individual research effect sizes is shown in Fig. 2. Each square's size shows its significance of the study and how it affected the overall effect size [23]. The random-effects model weights each primary study according to precision, which is mainly determined by sample size. Therefore, large primary studies have more precise estimates of effect size [23]. The confidence intervals for each study's effect magnitude are shown by the line's width. The width of the diamond below the studies indicates the confidence intervals (CI) for the summary effect size, while the diamond itself shows the mean effect size [23]. According to the results of the random-effects model, yoga significantly reduced depressive symptoms in pregnant women (g = .1.120, 95%CI .520, 1.719, $p < .001$). To examine the possibility of spontaneous recovery, one-group pre-post-test comparisons revealed that yoga significantly reduced depression in both uncorrelated ($g = 1.205$, 95%CI .720, 1.690, $p < .001$) and correlated ($g = 1.145$, 95%CI .739, 1.552, $p < .001$) groups. One group pre-post-test comparison for control groups showed no significant improvement of depressive symptoms for either uncorrelated ($g = -.186$, 95%CI -.678, .308, p = .463) or correlated ($g = -.235$ 95%CI -.709, .239, p = .332). Consequently, there was no indication of a spontaneous recovery from depression. See Table 2.

5.3. Heterogeneity

We found significant heterogeneity across primary studies (Q = 149.2, $p < .001$, $I^2 = 93$ %). Weighted sum of squares deviation is measured by the Q statistic, which was 149.2 ($p < .001$) [23,26]. Based on true variation in effect size, I^2 indicated that 93 % of the observed variance across trials was caused by these differences [23,26]. We thus performed a moderator analysis to investigate the sources of the heterogeneity.

5.4. Moderator analyses

To gain a deeper understanding of our findings and to generate hypotheses for future research, we examined the sources of variation in participant characteristics, methodological quality indicators, and intervention features. See Table 3. Only three substantial categorical moderators. Providing yoga to pregnant women with a mood disorder had a lesser effect size ($g = .088$, $k = 3$) than providing yoga to pregnant women without a mood disorder ($g = 1.034$, $k = 6$). Conducting yoga with unfunded had a greater ES to improve depressive symptoms (g = 1.978) than those with funded (g = .511). Interestingly, providing yoga in Eastern countries had a greater ES to improve depressive symptoms (g = 1.824) than providing yoga in Western countries (g = .401). No quality indicators

Table 1
Characteristics of primary studies ($s = 12$).

Characteristics	k	Min	Q1	Mdn.	Q3	Max	Mean	SD
Mean age (years)	10	25.73	26.60	28.96	29.78	31.51	28.43	1.92
Total Sample size at analysis								
- MBI group	12	12.00	22.00	35.00	45.25	51.00	33.17	13.45
- Control group	12	8.00	13.75	31.00	41.75	51.00	29.17	13.99
Weeks of structured MBI	10	2.00	6.25	10.00	12.00	12.00	8.90	3.73
Days across intervention (length)	10	7.00	42.88	63.00	77.00	77.00	56.75	24.56
Structured MBI session/week	10	1.00	1.00	2.50	5.50	14.00	3.90	4.04
Structured MBI min./session	10	20.00	20.00	55.00	78.75	120.00	54.50	33.70
Dose (length x duration)	10	210.0	1540.0	3005.0	4462.0	4620.0	2816.0	1577.4
Days after intervention measured	12	.00	.00	.00	.00	61.00	7.41	18.69
% Attrition, MBI group	12	.00	.00	1.88	17.93	32.00	8.66	12.44
% Attrition, Control group	12	.00	.00	6.73	17.39	38.46	11.55	14.46

s = number of studies providing data, Min = minimum, Q1 = first quartile, Mdn = median, Q3 = third quartile, Max = maximum.

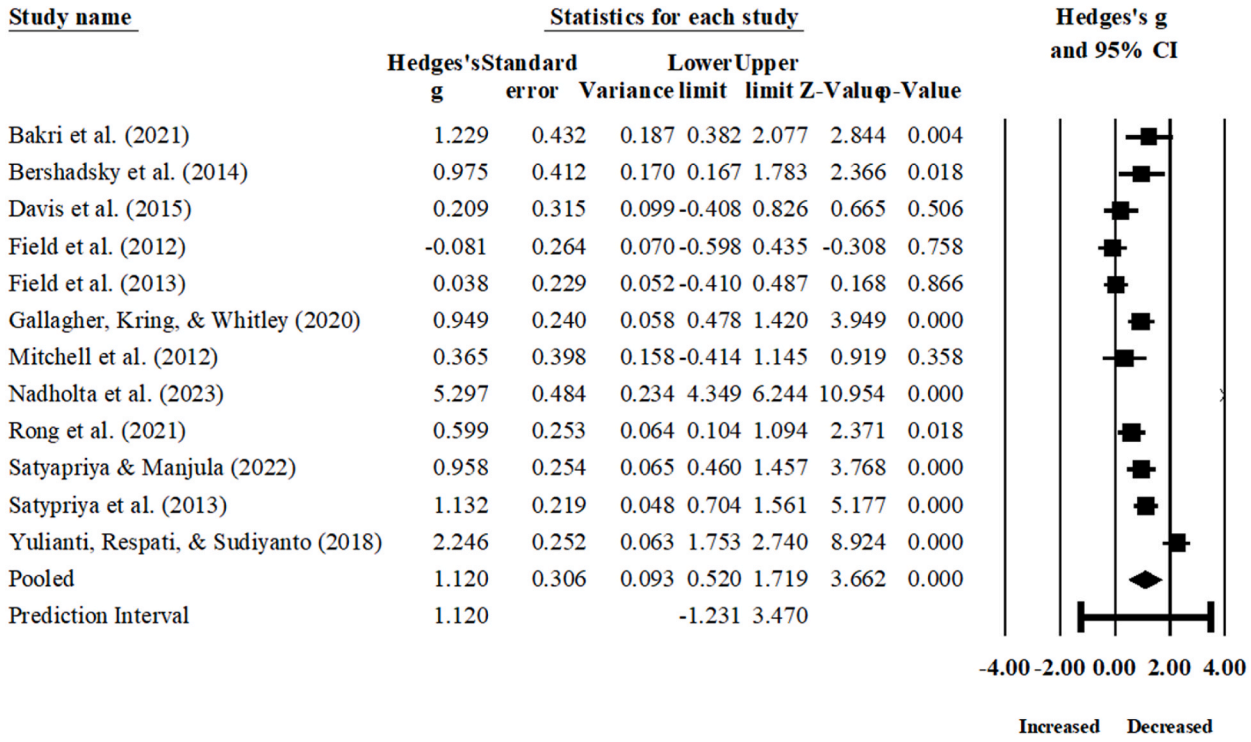

Fig. 2. Forrest's plot of the effect of yoga versus control group on depression among women with pregnancy.

Table 2
Effect size of Yoga vs Control groups.

Comparison	Yoga group							
	k	ES	*p* (ES)	95 % CI	SE	I^2	Q	*p*(Q)
MBI vs. Control groups	12	1.120	<.001	.520, 1.719	.306	92.62	149.16	<.001
Single group								
Yoga								
pre- vs. post (r = .0)	8	1.205	<.001	.720, 1.690	.248	76.94	30.36	<.001
pre- vs. post (r = .8)	8	1.145	<.001	.739, 1.552	.207	94.17	119.61	<.001
Control group								
pre- vs. post (r = .0)	8	−.186	.463	−.678, .308	.252	83.47	42.36	<.001
pre- vs. post (r = .8)	8	−.235	.332	−.709, .239	.242	96.59	205.41	<.001

showed moderator effects. See Table 4.

5.5. Publication bias

The funnel plot appears symmetrical. See Fig. 3. Also, Egger's test of the intercept was 5.46 and non-significant (95%CI-4.130, 15.055, $p = .116$), and the Begg and Mazumdar rank correlation test resulted in a non-significant Kendall's tau of .181 ($p = .225$). These results imply that publication bias does not exist. Nevertheless, these results should be regarded cautiously because there were only twelve included studies [23].

6. Discussion

The purpose of this systematic review and meta-analysis was to determine how pregnancy yoga improved depressed pregnant women. The findings indicate a tendency toward a significant decrease in both the number and proportion of pregnant women with diagnosed depression as well as their depression ratings as compared to control groups in the yoga groups. It is crucial to understand that a women might have depressed symptoms and an increase in emotional lability during pregnancy without being diagnosed with prenatal depression, even if both of these conditions are obviously related.

The outcomes of these research are connected to depressed symptoms rather than to clinical depression since the majority of

Table 3
Categorical moderator results for depression comparing yoga versus control groups.

Moderator	*k*	ES	SE	Var.	95%CI	Z	*p*(Z)	Q_{bet}	$p(Q_{bet})$
Source characteristics									
Funding								6.686	<.010
Unfunded	5	1.978	.436	.190	1.124, 2.833	4.538	<.001		
Funded	7	.511	.363	.132	−.201, 1.223	1.406	.160		
Country								6.889	.009
Western	6	.401	.382	.146	−.349, 1.151	1.048	.295		
Eastern	6	1.824	.384	.147	1.071, 2.576	4.750	<.001		
Method characteristics									
Blinded data collection								.961	.327
No	9	1.306	.370	.137	.581, 2.031	3.533	.001		
Yes	3	.590	.630	.393	−.645, 1.825	.937	.349		
Concealed allocation								1.647	.199
No	8	.833	.392	.154	.065, 1.601	2.125	.034		
Yes	4	1.706	.556	.309	.617, 2.796	3.069	.002		
Power of sample								.150	.698
No	5	.973	.504	.254	−.015, 1.961	1.930	.054		
Yes	7	1.228	.420	.177	.404, 2.051	2.922	.003		
Equally of participants 'characteristic at baseline								.600	.439
No	3	.645	.691	.478	−.710, 2.000	.933	.351		
Yes	6	1.303	.493	.243	.337, 2.270	2.642	.008		
Intervention characteristics									
Type of yoga								.408	.523
Yoga mindfulness	6	1.331	.458	.210	.433, 2.229	2.904	.004		
Yoga exercise	6	.918	.456	.208	.025, 1.812	2.014	.044		
Guided yoga								.006	.940
No	3	1.166	.645	.417	−.099, 2.431	1.807	.071		
Yes	9	1.109	.374	.140	.377, 1.842	2.970	.003		
Participants									
Major depressive disorder								4.555	.033
No	9	1.454	.319	.102	.828, 2.080	4.554	<.001		
Yes	3	.099	.549	.301	−.977, 1.175	.180	.857		

k = number of comparisons, Q = heterogeneity statistics, SE=standard error, Var. = variance, NR = not reported.

Table 4
Continuous moderators of the effects of yoga on depression.

Moderator	*k*	Slope	SE	Tau^2	Q_{model}	*p*
Study characteristic						
Publication year	12	.189	.085	1.040	115.60	.052
Sample characteristic						
Age (mean)	10	.222	.266	1.683	110.05	.428
Method characteristic						
%Attrition	12	.030	.037	1.536	148.85	.439
Intervention characteristics						
Intervention length (total day)	10	−.017	.021	1.672	103.46	.416
Number of session/wks.	10	.097	.129	1.705	103.12	.475
Duration of yoga min./session	10	.006	.015	1.805	107.12	.694
Dose (Length x Duration)	10	.000	.003	1.854	115.31	.970
Days After intervention measured	12	.006	.024	1.623	136.97	.807

k = number of comparisons, Q = heterogeneity statistics.

primary studies ($s = 9$) focused on pregnant women who had depressive episodes. Thus, from a worldwide standpoint, the results of this study may be applied and have significant therapeutic implications to recommend group and supervised yoga during pregnancy as a preventive measure against mental instability and related problems. These findings enable us to draw the conclusion that practicing yoga while pregnant is an effective means of preventing and dealing with prenatal depression. Despite earlier systematic reviews and meta-analyses evaluating the benefits of yoga for treating depression during pregnancy, these primary studies' control groups received different forms of treatment [16,29], so their results regarding the efficacy of yoga should be further confirmed. By comparing yoga with waitlist/control groups, we aimed to explore the effectiveness of yoga on depression in this meta-analysis. Our findings suggested that pregnant women with mild to moderate depression might benefit from yoga. Thus, our findings appear to be rational and supported by evidence. With a small number of studies conducted in pregnant women diagnosed with major depression ($s = 3$), Thus, the effectiveness of yoga in treating depression requires more investigation.

In addition, we found that providing yoga to pregnant women with depressive episodes had a greater effect size ($g = 1.454$, $k = 9$) than providing yoga to pregnant women with diagnosed mood disorder ($g = .099$, $k = 3$). Similarly, a systematic review and meta-

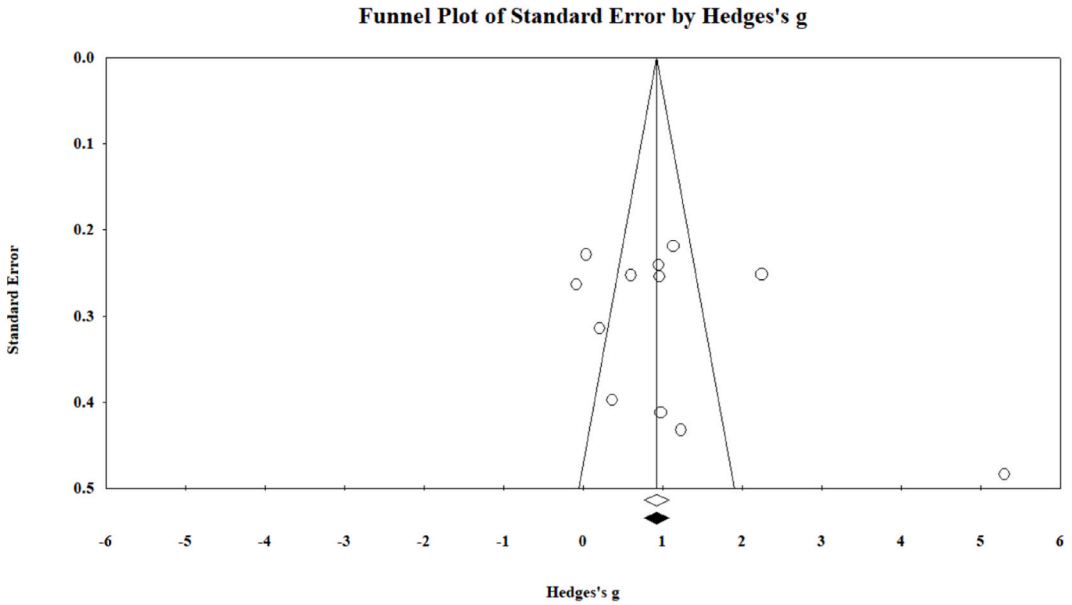

Fig. 3. Funnel plot for a meta-analysis of studies of yoga on depression among women with pregnancy.

analysis by Lin, Huang [15] found that prenatal yoga had a positive effect on depression in pregnant women without depression (SMD = −1.44, 95%CI, −3.09, .21) and for pregnant women with clinical depression (−1.93, 95%CI -3.08, −.77). One possible reason might be that yoga is a mind-body movement and a low intensity exercise, which might be more suitable for women dealing with mild to moderate depression episodes than for women with diagnosed depressive disorder. Thus, we would recommend clinicians and health providers encourage yoga for pregnant women with mild to moderate depression for improving depression episode. However, there were only 3 primary researchers conducted yoga in pregnant women with diagnosed with major depressive disorder, the further research is needed to explore.

Providing yoga in pregnant women in Eastern countries had a greater ES to improve depressive symptoms than providing yoga in Western countries. One explanation could be because yoga is a comprehensive practice that was first developed in South Asia (Eastern countries), where it was performed by a variety of South Asian people. It is a spiritual practice concerning the body and mind, the nature of the universe, and the purpose of existence [30]. Yoga was practiced for thousands of years in Eastern traditions before expanding towards the West [31]. Thus, pregnant women in Eastern countries might be more familiar with the practice of yoga than in Western countries. We recommend clinicians to encourage yoga for Eastern pregnant women to improve depressive symptoms.

Funded studies had a lesser ES to improve depression in pregnant women than those with unfunded. The ability of financed research teams to afford better methodological quality could be one explanation [32]. In our meta-analysis, the funded studies had a mean sample size of 58 (SD = 26), while unfunded studies had a mean of 67 (SD = 28) participants. Higher precision studies are given more weights in thorough meta-analyses since standard deviations are the primary determinant of accuracy [23,26], the funded studies may have had greater precision overall.

However, it is important to address the limitations of the present meta-analysis. Most primary research was conducted with pregnant women with mild depressive symptoms, and only three research teams conducted studies of pregnant women with diagnosed major depressive disorders (s = 3). Thus, the efficacy of yoga in pregnant women with diagnosed depressive disorder is needed to confirm. Moreover, we only considered papers written in English, excluding studies written in other languages that could have introduced language bias. Additionally, some subgroup analyses aimed at exploring moderators were based on a limited number of primary studies. As a result, the parameter estimation might be unreliable, necessitating careful interpretation of the findings. For example, only three research teams investigated the effects of yoga on depression in pregnant women using blinded data collectors (s = 3). However, our findings highlight future research ideas.

7. Implications and recommendations

The results of this systematic review and meta-analysis support the efficacy of yoga for depressed pregnant women. Therefore, in order to alleviate depressive symptoms in pregnant women who are depressed, nurses and other healthcare professionals may think about using yoga as an adjunct or alternative complementary treatment. With regard to implications for research, there were a few research teams ($s = 3$) who investigated the effectiveness of yoga in pregnant women with diagnosed depressive disorders. Future researchers might examine the effects of yoga in these groups of pregnant women. Last but not least, the long-term efficacy of yoga in this kind of population requires more research.

8. Conclusion

In this systematic review and meta-analysis of nine primary studies, we found a large effect size of yoga on depressive symptoms for women with pregnancy. Yoga may be used by clinicians and mental health professionals as an adjunct/alternative complementary treatment for pregnant women in order to alleviate depressive symptoms, especially in pregnant women with mild to moderate depression. Currently available studies included only a small number of primary studies ($s = 12$). Thus, larger trials, including both randomized and non-randomized control trials with a larger sample size, are required to confirm the benefits of yoga for pregnant women.

CRediT authorship contribution statement

Sasinun Punsuwun: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Data curation, Conceptualization. **Sarah Oerther:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Conceptualization. **Chuntana Reangsing:** Writing – review & editing, Writing – original draft, Software, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

Ethical approval

Not applicable.

Data available statement

The authors state that the data supporting the findings of this study are included within the article and its supplementary materials. Raw data can be obtained from the corresponding author upon reasonable request.

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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.e41664.

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