Review Article

The Effect of Yoga on Anxiety, Depression, and Stress in the Course of Pregnancy Period: A Meta-analysis Study

Abstract

This meta-analysis study was conducted to determine the level of effect of yoga applied during the prenatal period on anxiety, depression, and stress. For this study, research was conducted by screening the last 5 years of studies in PubMed, Web of Science, EBSCOhost, Google Scholar, and YOK Thesis Center databases from February to June 2024. After reviewing the studies, seven researches were included in the study. The quality assessment of the studies was conducted using the quality assessment tool prepared according to the Randomized Controlled Trial design by The Joanna Briggs Institute. CMA Ver. 2 was used for data synthesis. The data were synthesized using meta-analysis and narrative synthesis methods. According to the results of the meta-analysis, it has been determined that yoga applied during the prenatal period is effective in reducing anxiety levels (SMD: −0.730, 95% CI: −1.287 to −0.173; Z = −2.567, P = 0.010, I^2 = 79.498%). However, it was found that prenatal yoga did not have a statistically significant effect on depression (SMD: −2.137, 95% CI: −4.405–0.132; Z= −1.846, P = 0.065, I^2 = 97.722%) and stress levels (SMD: -4.861, 95% CI: −10.861–1.139; Z= −1.588, P = 0.112, I^2 = 98.569%). It is observed that yoga applied during the prenatal period is effective in reducing anxiety levels, but not effective in reducing depression and stress levels.

Keywords: *Anxiety, depression, pregnancy, stress, yoga*

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Introduction

Anxiety and depression are common psychological disorders encountered during the pregnancy process and can lead to serious health problems. The physical and hormonal changes that occur during this period, as well as various psychosocial factors such as anxiety, can have negative effects on childbirth and fetal outcomes.[1] Prenatal depression is a major concern, impacting around 11%–17% of women worldwide in the course of pregnancy and the postpartum period.[2,3]

Although screening for depression in the course of pregnancy and the postpartum period is now prevalent compared to past years,[4,5] most women experiencing prenatal depression do not receive mental health services.[6]

There is an effective pharmacological treatment available for prenatal depression; however, many women do not consider medication use to be safe in the course of pregnancy or breastfeeding.[3] Regarding psychotherapy, studies have shown that cognitive–behavioral therapy and interpersonal therapy can effectively treat prenatal depression.[7] However, some women face barriers such as limited time, childcare issues, and stigma. Considering the widespread occurrence of prenatal depression, the low rates of treatment, and the severe negative consequences, it is crucial to explore other treatment options.[3]

Yoga is a traditional practice that integrates physical postures, breath regulation, and meditation. Research has examined yoga as a treatment for depression in the general population, indicating that it may be more effective than a placebo and as effective as aerobic exercise and antidepressant drugs. Nevertheless, there are methodological limitations in the existing studies.[8,9] Evidence suggests that yoga is safe, feasible, and acceptable for pregnant women during pregnancy, and may be more beneficial than walking and standard prenatal exercises in terms of both physical and mental health.[10,11] A recent

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systematic review reports that Randomized Controlled Trials (RCTs), Non-Randomized, and Quasi-Experimental studies have determined the effects of pregnancy yoga on anxiety, depression, perceived stress, mode of delivery, and duration of labor. However, this study emphasizes the need for higher quality studies to definitively determine the effectiveness of pregnancy yoga interventions in terms of maternal and birth outcomes. It is also noted that in future studies, rigorous trial design and reporting should be ensured to develop evidence-based interventions.[12]

Therefore, we aimed to conduct a meta-analysis by reviewing the existing literature on RCTs to evaluate the effectiveness of prenatal yoga in the treatment of depression, anxiety, and stress during pregnancy.

Methods

This study is a meta-analysis conducted in accordance with the PRISMA checklist (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols, PRISMA Checklist).[13] In order to minimize bias risk, literature search, article selection, and data extraction processes were independently carried out by three researchers. These stages were reviewed and confirmed by the same researchers. In addition, the quality assessment of the studies included in the meta-analysis was meticulously conducted by the researchers.

Exclusion and inclusion criteria

This study has been conducted following the PICOS framework to evaluate the effects of yoga interventions during pregnancy on anxiety, depression, and stress. The criteria are as follows:

- Population (P): Pregnant women experiencing anxiety, depression, or stress
- Exclusion: Studies do not report outcomes relevant to these psychological factors
- Intervention (I): Yoga practices, including meditation, breathing techniques, and physical poses specifically designed for pregnant women
- Comparison (C): Groups not receiving yoga interventions, such as those on waiting lists or receiving standard care without yoga
- Outcomes (O): Studies must report at least one of the following outcomes with variability measures (e.g., SD, 95% CI): Changes in anxiety, depression, or stress levels during pregnancy
- Study Design (S): Experimental studies (randomized controlled trials) published in Turkish or English
- Exclusion: Letters to the editor, quasi-experimental studies, qualitative studies, case reports, case presentations, and systematic or traditional reviews.

Search strategy

A search was conducted between February and June 2024 using the keywords (((((((Pregnancy) OR (Pregnant)) OR (Prenatal)) OR (Antenatal)) OR (Pregnance)) AND (Yoga)) AND (Stress)) AND (Depression)) AND (Anxiety) in PubMed, EBSCOhost Web of Science, YOK National Thesis Center, and Google Scholar. The studies were transferred to Mendeley. In order to review the current literature, studies from the last 5 years were searched.

Selection of studies

As a result of the screening, initially 782 records were reached. After removing duplicates and irrelevant studies, 614 records were examined to select titles and abstracts. As a result of this review, 21 studies were selected for full-text review. Later, the 21 articles that were accessed in the full text were examined according to inclusion and exclusion criteria, and 7 studies reporting the effects of prenatal yoga on anxiety, depression, and stress were included in the analysis. Explanations regarding the selection process of the articles are provided in Figure 1.

Data extraction

In the collection of research data, a data extraction tool developed by the researchers was used. This tool enabled the systematic collection of information related to the authors and publication years of studies included in the meta-analysis, data collection years, countries where the study was conducted, measurement tools used, sample sizes, and intervention durations [Table 1].

Ethical principles

This study was conducted as a systematic meta-analysis based on research published in the literature.

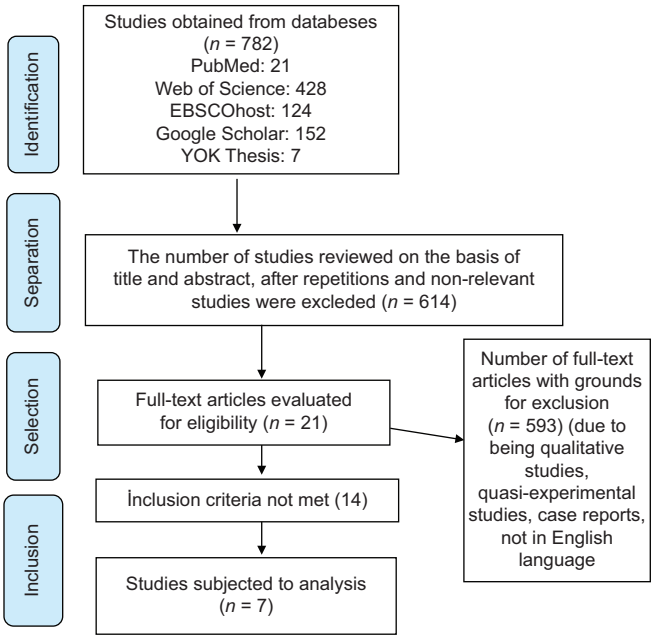

Figure 1: Selection of studies according to Preferred Reporting Items for Systematic reviews and Meta-Analyses flow diagram

Table 1: Characteristics and results of the included studies

Author/year	Data collection year	Country	Sample size	Scale	Intervention time	Patient population	Quality Score
Bhartia *et al*., 2019[17]	2015–2017	India	Experimental group: 38 Control group: 40	PSS	12 sessions	Pregnancy	Yes: 9/13 No: 3/13 Uncertain: 1/13 Not applicable: 0/13
Gallagher *et al*., 2020[18]	2012–2014	USA	Experimental group: 48 Control group: 31	HADS-D	3 sessions	Pregnancy	Yes: 9/13 No: 3/13 Uncertain: 1/13 Not applicable: 0/13
Indrayani *et al*., 2023[19]	2015–2016	Indonesia	Experimental group: 30 Control group: 30	HARS	2 sessions per week until delivery	Pregnancy	Yes: 9/13 No: 3/13 Uncertain: 1/13 Not applicable: 0/13
Kundartı *et al*., 2020[21]	2019	Indonesia	Experimental group: 30 Control group: 29	STAI	8 sessions	Pregnancy	Yes: 11/13 No: 2/13 Uncertain: 0/13 Not applicable: 0/13
Mohyadin *et al*., 2020[20]	-	Iran	Experimental group: 42 Control group: 42	STAI	6 sessions	Pregnancy	Yes: 8/13 No: 2/13 Uncertain: 0/13 Not applicable: 1/13
Nadholta *et al*., 2023[22]	2021-2023	Iran	Experimental group: 34 Control group: 43	DASS	5 sessions per week 16 weeks	Pregnancy	Yes: 11/13 No: 2/13 Uncertain: 0/13 Not applicable: 0/13
Rong *et al*., 2021[23]	2019	China	Experimental group: 32 Control group: 32	EPDS STAI	3 sessions per week 12 weeks	Pregnancy	Yes: 10/13 No: 2/13 Uncertain: 1/13 Not applicable: 0/13

PSS: Perceived Stress Scale, HADS-D: Hospital Anxiety and Depression Scale, HARS: Hamilton Anxiety Rating Scale, STAI: State-Trait Anxiety Inventory, DASS: Depression Anxiety Stress Scale, EPDS: Edinburgh Postnatal Depression Scale

Assessment of methodological quality of studies

The methodological quality of the studies included in the meta-analysis was evaluated using the quality assessment tool developed by the Joanna Briggs Institute for randomized controlled trials, which consists of 13 questions.[14] The questions in this assessment tool were answered with "Yes," "No," "Unclear," and "Not Applicable" options. Two researchers (A. Ç, and S. Y.) independently evaluated the methodological quality of the studies, and the results for all studies included in the meta-analysis were determined through discussion and consensus. The evaluation results for each study were presented as "Quality Score" in Table 1.

Data synthesis

For the statistical calculations of this study, CMA Ver. 2 was used. The heterogeneity between the examined studies was evaluated with the Chi-square statistic and Higgins I^2 tests, and it was accepted that I^2 showing more than 50% indicates significant heterogeneity. Studies with I^2 ≤50% and $P > 0.1$ were evaluated with the fixed effects model; however, studies with I^2 >50% and $P > 0.1$ were evaluated using the random effects model.[15]

The Tau-square statistic was used to complete the evaluation of variance and heterogeneity among studies. Standardized mean difference (SMD) with a 95%

confidence interval (CI) was used to assess the effect size dependent on the same outcome with different measurement tools. Forest plots were prepared to visualize SMD with a 95% CI. Subsequently, the average of these *D* values was taken to calculate the overall effect size. The *D* value was converted to a *Z* value to assess statistical significance. Funnel plots were used to examine and visualize publication bias. Publication bias was detected with an asymmetry in the funnel plot. In addition, an Egger test was conducted to evaluate publication bias. All values were two-sided and considered significant at a threshold of 0.05.[16]

All studies included in the analysis are randomized controlled trials. The combined sample size across these studies is 254 in the intervention group and 247 in the control group [Table 1].

Risk of bias assessment (JBI)

It has been determined that more than 50% of the items of the evidence quality assessment tool are met in all studies included in the meta-analysis. This finding is important in terms of showing that the information presented in the meta-analysis is based on studies with an acceptable level of evidence quality [Table 1].

The studies demonstrated generally moderate-to-high methodological quality. Four studies[17-20] met 9 out of 13 quality criteria, indicating acceptable methodological rigor with some limitations. One study[21] and one recent study[22] met 11 out of 13 criteria, showing relatively higher quality. The study by Rong *et al*. (2020) scored 10/13.[23] Overall, common limitations among the studies included insufficient reporting on allocation concealment and blinding procedures. These results suggest that, while the majority of studies were of acceptable quality, potential sources of bias should be taken into account when interpreting the findings of this meta-analysis.

Grading of recommendations, assessment, development and evaluation assessment

Two authors (A. Ç. and S. Y.) independently conducted the quality assessment of the included studies using the JBI checklist and performed a Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) evaluation for the outcomes analyzed in the meta-analysis. Any discrepancies between the two reviewers were resolved through discussion, and if needed, consultation with a third reviewer.[24]

For the outcome of anxiety, the evidence was rated as moderate quality due to high heterogeneity but was upgraded because of the strong effect size and inclusion of randomized controlled trials. The evidence related to the effects of yoga on depression and stress during pregnancy was rated as low quality, mainly due to a limited number of studies, high heterogeneity, and nonsignificant findings. These results suggest that yoga interventions during pregnancy may be particularly beneficial in reducing anxiety symptoms; however, further high-quality studies are needed to clarify their impact on depression and stress [Table 2].

Results of the meta-analysis on the effects of yoga on anxiety in the course of pregnancy

In this study, publication bias was evaluated using two approaches: (a) a funnel plot [Figure 2] and (b) Egger's regression test.[25]

In this dataset, the cutoff point (B0) obtained using the Egger method is calculated as −9.66898, with a 95% CI ranging from 12.99092 to 46.22645. The calculated $t = 0.74429$, the degrees of freedom (df) is 2, and the two-tailed $P = 0.53427$. These results indicate that publication bias is not statistically significant ($P = 0.07837$).

A meta-analysis based on the findings of 4 RCT with 267 participants measured post-intervention anxiety symptom scores using the State-Trait Anxiety Inventory and Hamilton Anxiety Rating Scale.[19-21,23] The meta-analysis supports that pregnancy yoga interventions have a statistically significant beneficial effect on anxiety (SMD: −0.730, 95% CI: −1.287 to −0.173; $Z = -2.567$, $P = 0.010$). Additionally, a high level of heterogeneity was found among the studies ($I^2 = 79.498\%$) [Figure 3].

Results of the meta-analysis on the effects of yoga on depression in the course of pregnancy

The funnel plot showing studies on the effect of prenatal yoga on anxiety is given in Figure 4.

In this dataset, the cutoff point (B0) obtained using the Egger method is calculated as −19.33498, with a 95%

Table 2: Grading of recommendations, assessment, development, and evaluation summary of findings table

Outcome	Number of Studies	Participants	Effect size (SMD, 95% CI)	Certainty of Evidence	Rationale
Anxiety	4 RCTs	267	−0.730 (−1.287–−0.173)	Moderate (⊕⊕⊕○)	Downgraded: High heterogeneity (I^2=79.5%) Upgraded: Strong effect size, randomized controlled trials
Depression	3 RCTs	220	−2.137 (−4.405–0.132)	Low (⊕⊕○○)	Downgraded: High heterogeneity (I^2=97.7%), nonsignificant result, small sample size
Stress	2 RCTs	110	−4.861 (−10.861–1.139)	Low (⊕⊕○○)	Downgraded: Few studies, very high heterogeneity (I^2=98.6%), nonsignificant results

CI: Confidence interval, RCTs: Randomized controlled trials, SMD: Standardized mean difference

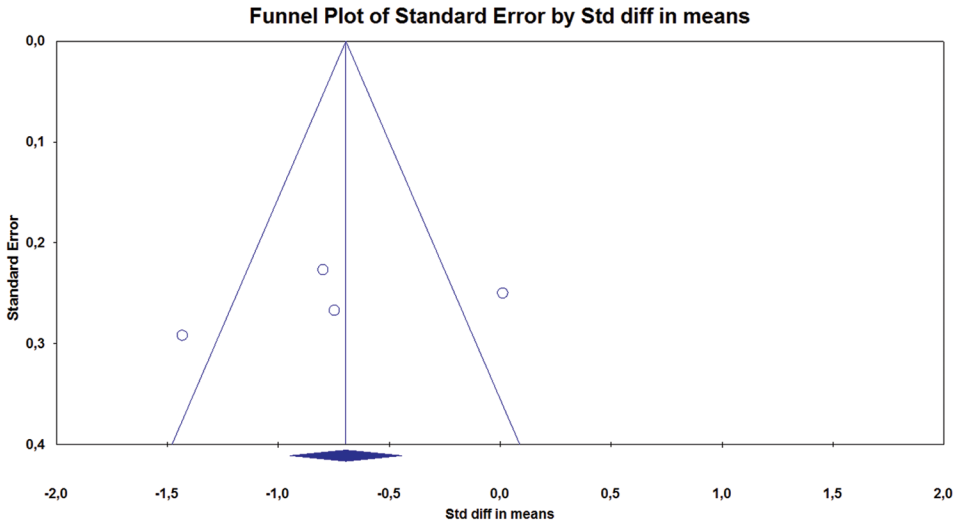

Figure 2: Funnel plot of studies reporting the effect of yoga on anxiety during the pregnancy

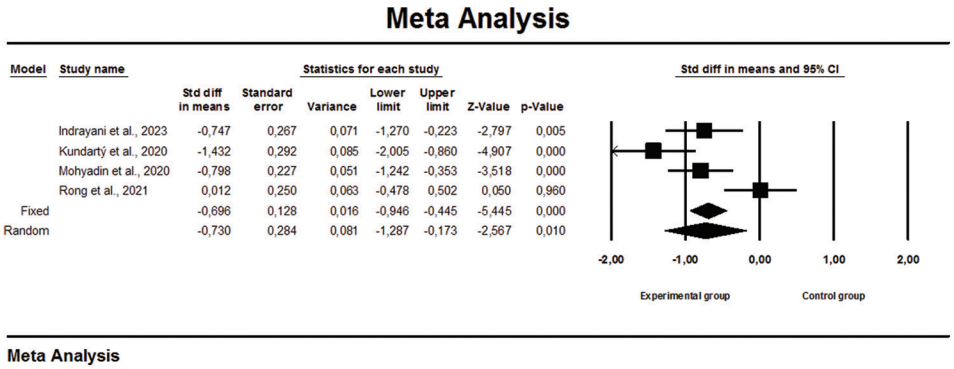

Figure 3: Forest plot of studies reporting the effect of yoga on anxiety during the pregnancy

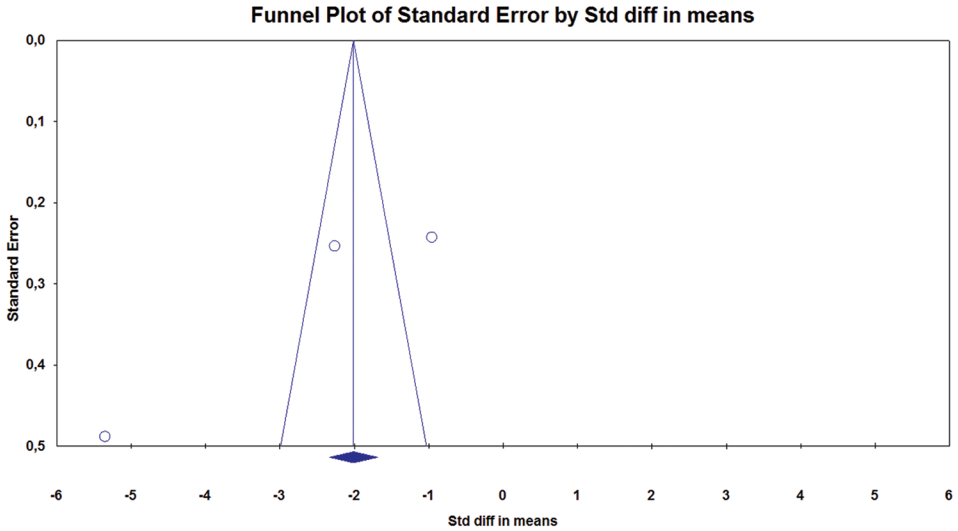

Figure 4: Funnel plot of studies reporting the effect of yoga on depression during the pregnancy

CI ranging from −87.92026–49.25030. The calculated $t = 3.58203$, df is 1, and the two-tailed $P = 0.17331$. These results indicate that publication bias is not statistically significant ($P = 0.07837$).

A meta-analysis based on the findings of 3 RCTs with 220 participants measured postintervention depression symptom scores using the Hospital Anxiety and Depression Scale (HADS-D), Depression Anxiety Stress Scale,

and Edinburgh Postnatal Depression Scale.[18,22,23] The meta-analysis (SMD: −2.137, 95% CI: −4.405-0.132; Z = −1.846, P = 0.065, I^2 = 97.722%) shows that pregnancy yoga interventions did not have a statistically significant effect on depression [Figure 5].

Results of the meta-analysis on the effects of yoga on stress in the course of pregnancy

Bias control could not be performed because it did not meet the minimum requirement of 3 studies.

A meta-analysis based on the findings of 2 RCTs with 55 participants each measured postintervention depression symptom scores using the Perceived Stress Scale.[17,22] The meta-analysis (SMD: −4.861, 95% CI: −10.861–1.139; Z = −1.588, P = 0.112, I^2 = 98.569%) based on the findings of these studies shows that pregnancy yoga interventions do not have a statistically significant effect on stress [Figure 6].

Discussion

Pregnancy is a period marked by significant physiological and psychological changes for women. Increased hormone levels during this time heighten the susceptibility to psychological disorders, postpartum depression, and particularly anxiety. Research indicates that anxiety and stress experienced during pregnancy can have detrimental effects on both the mother and the fetus, potentially impacting the child's postnatal development.[26,27] Anxiety and stress during pregnancy can lead to serious consequences, such as preeclampsia, premature birth, low birth weight, postpartum depression, and even long-term developmental issues for the child.[28,29] In this context, the potential of prenatal yoga to mitigate such adverse outcomes is a significant finding. Prenatal yoga not only reduces levels of anxiety, depression, and stress but also enhances the overall psychological well-being of pregnant women.

Effect of yoga on anxiety in the course of pregnancy

The findings of this meta-analysis demonstrate that yoga during pregnancy is effective in reducing anxiety levels. The results obtained from our study support the findings of previous research regarding the positive effects of prenatal yoga on anxiety symptoms. For instance, a meta-analysis showed that women who practiced prenatal yoga experienced 14% less anxiety compared to those who did not.[30] This finding underscores the mental health benefits of yoga during pregnancy.

Additionally, the study based on a Forest plot analysis, revealed that prenatal yoga reduced anxiety levels by 0.84, which aligns with the results of our study, as we also observed a significant effect of prenatal yoga intervention on anxiety (SMD: −20.730, 95% CI: −1.287 to −0.173; P = 0.010).[31] Such findings provide crucial evidence supporting the effectiveness of prenatal yoga in alleviating anxiety symptoms.

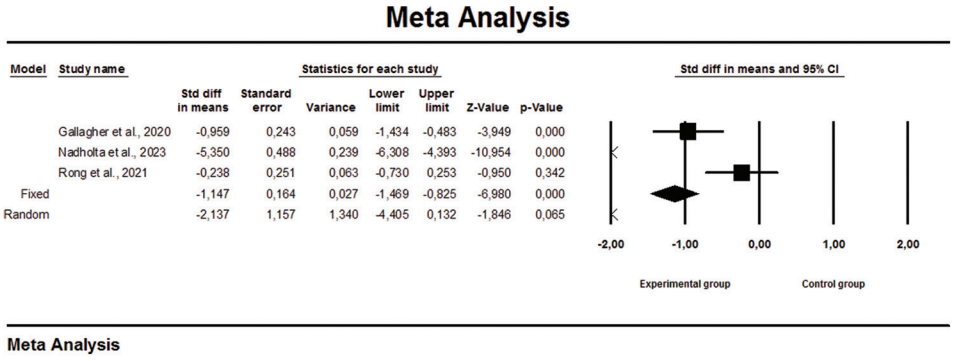

Figure 5: Forest plot of studies reporting the effect of yoga on depression during the pregnancy

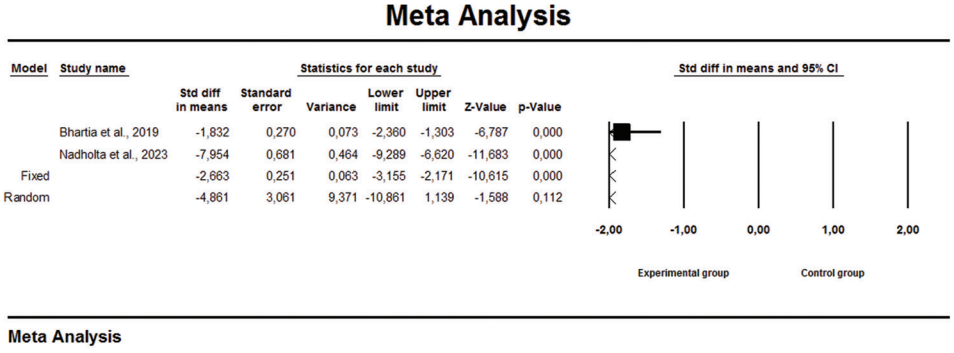

Figure 6: Forest plot of studies reporting the effect of yoga on stress during the pregnancy

Similarly, the meta-analysis demonstrated that prenatal yoga significantly reduced anxiety levels, highlighting it as an effective method for pregnant women.[32] Our study also found a statistically significant effect of prenatal yoga interventions on anxiety symptoms. However, the generalizability of our findings may be limited due to the smaller number of RCTs included in the analysis.

The high heterogeneity observed (I^2 = 79.498%) indicates variability in our results, suggesting that the effectiveness of prenatal yoga interventions may vary based on different protocols and participant profiles. As Corrigan *et al*. noted, factors such as the duration and frequency of interventions can influence their effectiveness in reducing anxiety symptoms. Their study reported that 6–12 sessions of yoga were effective in reducing anxiety symptoms.[12] The findings from the four studies included in our analysis also suggest that prenatal yoga can yield effective results even with short-term interventions. However, further studies are needed to evaluate the long-term effects of these interventions.

A meta-analysis also supports the positive effects of yoga on pregnant women. Their study found a statistically significant reduction in anxiety levels in the yoga group, further confirming that prenatal yoga interventions were a safe and effective method.[33] However, as observed in our findings, the heterogeneity in these studies highlights the need for further research to optimize such interventions across different contexts and populations.

In conclusion, the existing literature and the findings of this meta-analysis support the effectiveness and safety of prenatal yoga in reducing anxiety levels. However, given the methodological limitations, more high-quality randomized controlled trials are needed to more robustly establish the efficacy of prenatal yoga.

Effect of yoga on depression in the course of pregnancy

In this meta-analysis, the effects of yoga practices during the prenatal period on depression levels were investigated, and it was concluded that these practices were not effective. Most previous studies have presented findings suggesting that yoga reduces depression. For example, a meta-analysis that included studies involving 2217 pregnant women, reported that prenatal yoga interventions reduced depression levels.[12] Similarly, the study that reviewed 12 randomized controlled trials, also found a significant reduction in depression levels in the yoga group.[34]

The meta-analysis by Kwon *et al*. suggested that in addition to reducing depression, yoga alleviates pain responses and enhances both maternal immunity and emotional well-being.[34] However, the study by Ng *et al*. found that while yoga-based interventions had a significant effect on depression, most of the studies reviewed were conducted with participants who only had mild depression and suffered from methodological limitations, such as a lack of blinding and small sample sizes.[35]

Similarly, Jarbou and Newell reported that yoga and other forms of exercise improved symptoms of depression and anxiety during pregnancy.[36] However, they emphasized that these findings were based on a limited number of studies, and the superiority of yoga interventions over control groups remained unclear. Villar-Alises *et al*., in their systematic review and meta-analysis, also noted that prenatal yoga-based interventions showed positive effects on psychological symptoms, such as depression and anxiety.[37] Nonetheless, they highlighted that the methodological quality of the studies reviewed was generally low, and the same studies were repeatedly used in different meta-analyses.

While this meta-analysis supports some of the findings presented in the existing literature, it also demonstrates the need for further research on the effects of yoga practices on depression. The presence of methodological limitations complicates the generalizability of findings in this area. Therefore, there is a need for studies of higher methodological quality that more comprehensively examine the relationship between prenatal yoga and depression.

Effect of yoga on stress in the course of pregnancy

This meta-analysis found that prenatal yoga was not effective in reducing anxiety, a result that diverges from several previous studies. For instance, a meta-analysis involving 2217 pregnant women indicated that prenatal yoga interventions reduced perceived stress levels, although the quality of evidence for these outcomes ranged from low to very low.[12] The inconsistency in findings may be attributed to variations in study design, intervention protocols, or population characteristics. The heterogeneity across the included studies suggests that factors such as the frequency, duration, and type of yoga practice could significantly influence the outcomes related to anxiety and stress reduction.

Moreover, a meta-analysis using the PICO framework demonstrated that pregnant women who practiced prenatal yoga experienced a 1.23-fold decrease in stress levels from pregnancy to birth compared to non-practitioners.[30] This suggests a measurable benefit of yoga, particularly for pregnant women stress management, though it is important to consider that stress and anxiety are multifactorial, and their reduction may be influenced by other psychosocial interventions or individual coping mechanisms. The physiological mechanisms through which yoga may alleviate stress could include the promotion of relaxation, improved breathing, and enhanced mindfulness, all of which contribute to better emotional regulation during pregnancy.

In contrast to the findings of the present meta-analysis, Ng *et al*. reported that yoga improved psychological well-being in patients with perinatal depression.[35] This is particularly significant, as stress and anxiety are closely linked to

adverse pregnancy outcomes, including preterm birth and low birth weight. The potential for prenatal yoga to mitigate these risks through psychological health improvements could offer a compelling argument for its inclusion in prenatal care programs. However, such conclusions must be tempered by the acknowledgment of the variability in evidence quality.

Further support for the benefits of prenatal yoga comes from a systematic review of 16 studies, which found that antenatal yoga could safely and effectively reduce stress, anxiety, depression, and pain responses while potentially enhancing maternal immunity and emotional well-being.[34] Despite these promising results, it is crucial to critically assess the methodological quality of the included studies. Many of these studies suffer from small sample sizes, lack of standardized yoga protocols, and potential biases related to participant self-reporting of stress and anxiety. Therefore, while the findings highlight positive trends, the overall robustness of the evidence is limited.

In this meta-analysis, the finding that prenatal yoga was not effective in reducing stress contrasts with other literature, which generally supports its psychological benefits. This discrepancy underscores the need for more rigorous and standardized research to conclusively determine the effectiveness of prenatal yoga. The low quality of evidence in many studies, as noted in previous reviews, calls for improved methodological designs, including larger sample sizes, randomized controlled trials, and consistent intervention frameworks.

Overall, while prenatal yoga is widely considered safe and potentially beneficial for psychological well-being during pregnancy, the findings are constrained by methodological limitations. Future research should aim to address these limitations by employing more robust study designs, ensuring higher-quality evidence, and exploring the specific components of yoga that contribute to stress and anxiety reduction. Additionally, further exploration into the long-term effects of prenatal yoga on both maternal and fetal outcomes could provide more comprehensive insights into its role in prenatal care.

Conclusion

Anxiety and stress experienced in the course of pregnancy can have negative effects on both the mother and the fetus, and can even lead to postpartum depression. This meta-analysis has shown that yoga applied during the prenatal period has a significant overall effect on anxiety. However, it has been found to have no significant effect on stress and depression.

Suggestions

It is believed that more research is needed to evaluate the effectiveness of yoga during the prenatal period. Future studies should focus on larger and more diverse populations to enhance the generalizability of the findings.

Limitation of studies

In order to review the current literature, meta-analysis has included studies from the last 5 years. This situation may reduce the strength of evidence presented by the studies. Although this meta-analysis provides an overview of the immediate effects of yoga, longitudinal studies are needed to assess the long-term impact of prenatal yoga on mental health outcomes post-delivery. Understanding how these interventions may influence postpartum anxiety, depression, and stress can enhance the overall understanding of maternal mental health trajectories.

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Conflicts of interest

There are no conflicts of interest.

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