


The Effectiveness of Prenatal Yoga in Reducing Anxiety and Improving Sleep Quality Among Pregnant Women A Randomized Controlled Trial

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Article Info	ABSTRACT
<p>Article history:</p> <p>Received September 23, 2024 Revised November 20, 2024 Accepted December 12, 2024</p> <p>Corresponding Author:</p> <p>Darma Afni Hasibuan Midwifery Study Program, Akademi Kebidanan Matorkis, Indonesia Email: afnihasibuan87@gmail.com</p>	<p>Anxiety and sleep disturbances are common complications during pregnancy, affecting maternal well-being and fetal development . Prenatal yoga has emerged as a promising non-pharmacological intervention for addressing these concerns . This study aimed to evaluate the effectiveness of prenatal yoga in reducing anxiety and improving sleep quality among pregnant women through a mixed-methods randomized controlled trial. A convergent parallel mixed-methods design was employed with 120 pregnant women (20-36 weeks gestation) randomized to intervention (n=60) and control (n=60) groups . The intervention group received 8 weeks of structured prenatal yoga sessions twice weekly, while the control group received standard antenatal care . Quantitative measures included the State-Trait Anxiety Inventory (STAI) and Pittsburgh Sleep Quality Index (PSQI), assessed at baseline, 4 weeks, and 8 weeks . Qualitative data were collected through semi-structured interviews and analyzed using thematic analysis. Significant reductions in anxiety levels were observed in the yoga group compared to controls ($p < 0.001$) . Sleep quality improved significantly in the intervention group, with PSQI scores decreasing from 7.2 ± 1.8 to 4.1 ± 1.2 ($p < 0.001$) . Qualitative themes revealed enhanced emotional regulation, increased self-efficacy, and improved pregnancy experiences. Prenatal yoga is an effective intervention for reducing anxiety and improving sleep quality during pregnancy . The integration of quantitative and qualitative findings provides comprehensive evidence supporting the implementation of prenatal yoga programs in maternal healthcare services</p> <p>Keywords: Yoga, prenatal, sleep, quality</p> <p>This article is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.</p> 

1. INTRODUCTION

Pregnancy represents one of the most profound physiological and psychological transitions in a woman's life, characterized by complex hormonal fluctuations, anatomical changes, and emotional adaptations that can significantly impact maternal well-being . During this transformative period, women commonly experience a constellation of challenges including anxiety, sleep disturbances, and physical discomfort that can adversely affect both maternal and fetal health outcomes . The prevalence of these complications has reached concerning levels globally, with anxiety disorders affecting approximately 10-15% of pregnant women worldwide, while sleep disturbances impact an even larger proportion of expectant mothers [1].

The Global Burden of Pregnancy-Related Mental Health Concerns

The magnitude of pregnancy-related anxiety has become increasingly evident through contemporary research, revealing that maternal mental health complications are far from benign conditions . Studies indicate that antenatal anxiety is associated with significant adverse perinatal outcomes, including increased odds for preterm birth (pooled

odds ratio = 1.54; 95% confidence interval, 1.39 to 1.70), lower mean birth weight, and increased likelihood of cesarean delivery . Furthermore, research demonstrates that in Indonesia specifically, approximately 71.9% of pregnant women experience anxiety symptoms, highlighting the particularly acute nature of this challenge in Southeast Asian populations [2].

The bidirectional relationship between anxiety and sleep disturbances during pregnancy creates a complex web of interconnected complications that can perpetuate and exacerbate maternal distress . Meta-analyses reveal that the overall prevalence of insomnia symptoms during pregnancy reaches 43.9% globally, with particularly high rates observed in the third trimester where prevalence can exceed 42.4% . These sleep disturbances are not merely uncomfortable inconveniences but represent serious medical concerns that can impact pregnancy outcomes, maternal immune function, and fetal development [3].

The third trimester of pregnancy presents unique challenges to maternal sleep quality, with physiological changes including increased fetal size, hormonal fluctuations, and physical discomfort contributing to significant sleep disruption . Research indicates that sleep quality deteriorates progressively throughout pregnancy, with the Pittsburgh Sleep Quality Index scores increasing from approximately 5.31 in the second trimester to 7.03 in the third trimester . Common sleep-related complaints during late pregnancy include frequent nocturnal awakening, difficulty maintaining sleep continuity, restless legs syndrome affecting up to one-third of pregnant women, and sleep-disordered breathing [4]

The consequences of poor sleep quality extend beyond maternal discomfort, with studies demonstrating significant associations between sleep disorders and adverse pregnancy outcomes including preeclampsia, gestational diabetes, preterm labor, and cesarean delivery . Additionally, the relationship between sleep disturbances and maternal mental health is bidirectional, with anxiety contributing to sleep problems and poor sleep quality exacerbating anxiety symptoms, creating a potentially harmful cycle for both mother and fetus [5].

2. METHOD

This study employed a convergent parallel mixed-methods randomized controlled trial design . The quantitative component utilized a two-arm parallel randomized controlled trial comparing prenatal yoga intervention to standard care controls . Simultaneously, a qualitative descriptive study explored participants' experiences through semi-structured interviews . The integration of quantitative and qualitative data occurred during analysis and interpretation phases, following established mixed-methods protocols.

The study was conducted at three major hospitals in Jakarta, Indonesia, between January 2024 and October 2024 . Eligible participants included pregnant women aged 18-40 years, at 20-36 weeks gestation, with singleton pregnancies and no contraindications to physical exercise . Exclusion criteria included high-risk pregnancies, previous yoga experience, psychiatric disorders requiring medication, and inability to attend regular sessions. Power analysis indicated a required sample size of 120 participants (60 per group) to detect a medium effect size (Cohen's $d = 0.5$) with 80% power and $\alpha = 0.05$. Accounting for 20% attrition, 150 participants were initially recruited [6].

Participants were randomized using computer-generated random sequences with block randomization (block size = 4) to ensure balanced group allocation . Allocation concealment was maintained through sequentially numbered, sealed envelopes . Due to the nature of the intervention, participants and instructors could not be blinded, but outcome assessors and data analysts remained blinded to group allocation .

The prenatal yoga intervention consisted of 8 weeks of supervised sessions, conducted twice weekly for 60 minutes each . Sessions were led by certified prenatal yoga instructors trained in the standardized protocol . Each session included: warm-up exercises (10 minutes), modified yoga postures appropriate for pregnancy (30 minutes), breathing techniques (10 minutes), and relaxation/meditation (10 minutes) [7].

The yoga protocol incorporated evidence-based elements from previous successful interventions, including gentle stretching, strengthening exercises, and mindfulness practices . Safety modifications addressed pregnancy-specific considerations such as avoiding supine positions after 20 weeks and contraindicated poses .

Control group participants received standard antenatal care according to local guidelines, including routine prenatal visits and standard health education . To minimize contamination, control participants were offered yoga classes after study completion .

Quantitative Measures

State-Trait Anxiety Inventory (STAI)

The STAI is a widely validated 40-item questionnaire measuring both state (situational) and trait (dispositional) anxiety . State anxiety reflects current anxiety levels, while trait anxiety indicates general anxiety proneness . The STAI has demonstrated excellent reliability in pregnant populations (Cronbach's $\alpha = 0.89-0.95$) and sensitivity to intervention effects [8].

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a standardized 19-item questionnaire assessing sleep quality over the past month . Global PSQI scores range from 0-21, with scores ≥ 5 indicating poor sleep quality . The instrument has been extensively validated in pregnant populations and demonstrates good internal consistency (Cronbach's $\alpha = 0.83$) .

Demographic and Clinical Variables

Standardized forms collected maternal age, education, occupation, parity, gestational age, and medical history . Additional measures included body mass index, pregnancy complications, and medication use .

Qualitative Methods

Semi-structured interviews were conducted with a purposive sample of 30 intervention participants to explore their experiences with prenatal yoga . Interview guides addressed perceived benefits, challenges, lifestyle changes, and recommendations for program improvement . Interviews lasted 30-45 minutes and were conducted in Bahasa Indonesia by trained researchers [9].

Interviews were audio-recorded, transcribed verbatim, and translated into English by bilingual researchers . Data saturation was achieved when no new themes emerged from interviews .

Data Collection Procedures

Quantitative assessments occurred at baseline (T0), 4 weeks (T1), and 8 weeks (T2) post-randomization . Questionnaires were administered in quiet, private settings by trained research assistants . Qualitative interviews were conducted within 2 weeks of intervention completion .

Data Analysis

Quantitative Analysis

Statistical analyses followed intention-to-treat principles using SPSS version 28.0 . Descriptive statistics characterized baseline demographics and clinical variables . Between-group differences at baseline were assessed using chi-square tests for categorical variables and t-tests for continuous variables [10].

Primary outcomes were analyzed using repeated measures ANOVA to examine changes over time between groups . Effect sizes were calculated using Cohen's d, with values of 0.2, 0.5, and 0.8 representing small, medium, and large effects, respectively . Missing data were handled using multiple imputation methods .

Qualitative Analysis

Qualitative data were analyzed using inductive thematic analysis following Braun and Clarke's six-step framework . Initial coding was performed independently by two researchers, followed by theme development and review . NVivo 12 software facilitated data management and analysis . Trustworthiness was enhanced through member checking, peer debriefing, and maintaining an audit trail.

3. RESULTS AND DISCUSSION

This section presents the detailed findings from the randomized controlled trial assessing the effectiveness of prenatal yoga in reducing anxiety and improving sleep quality among pregnant women. The results include quantitative analyses of anxiety and sleep quality scores over the intervention period, as well as qualitative insights from participant interviews. Integration of these data provides a comprehensive understanding of the intervention's impact.

3.1. Participant Flow and Baseline Characteristics

A total of 150 pregnant women were screened for eligibility; 120 met inclusion criteria and were randomized equally into the prenatal yoga intervention group (n=60) and control group receiving standard antenatal care (n=60). Attrition was minimal, with 57 participants completing the intervention in the yoga group and 58 in the control group.

Baseline demographic and clinical characteristics were comparable between groups (Table 1). The mean age was 28.4 years (SD 4.2), and mean gestational age at enrollment was 24.8 weeks (SD 3.6). Approximately 55% were primigravida, and 45% multigravida.

Table 1. Participant Flow & Baseline Characteristics

Characteristic	Prenatal Yoga Group (n=60)	Control Group (n=60)	p-value
Age (years), mean \pm SD	28.5 \pm 4.1	28.3 \pm 4.3	0.78
Gestational age (weeks)	24.7 \pm 3.5	24.9 \pm 3.7	0.82
Primigravida, n (%)	33 (55%)	33 (55%)	1.00
Education \geq High School, n (%)	48 (80%)	50 (83%)	0.67
Employed, n (%)	35 (58%)	37 (62%)	0.68

Anxiety Outcomes

Anxiety was measured using the State-Trait Anxiety Inventory (STAI), with separate scores for state and trait anxiety recorded at baseline (T0), 4 weeks (T1), and 8 weeks (T2).

State Anxiety:

At baseline, mean state anxiety scores were similar between groups (Yoga: 42.8 ± 8.4 ; Control: 43.2 ± 8.1 ; $p=0.76$). After 8 weeks, the yoga group showed a significant reduction to 32.1 ± 6.7 , whereas the control group had a marginal decrease to 41.9 ± 8.3 ($p < 0.001$ for group \times time interaction).

Trait Anxiety:

Similarly, trait anxiety decreased significantly in the yoga group from 44.5 ± 7.9 at baseline to 34.7 ± 6.5 at 8 weeks, compared to a slight change in controls (44.8 ± 8.2 to 43.5 ± 7.8 ; $p < 0.001$).

Table 2. State and trait anxiety scores over time.

Time Point	Prenatal Yoga State Anxiety (mean \pm SD)	Control State Anxiety (mean \pm SD)	p-value (Group \times Time)
Baseline	42.8 ± 8.4	43.2 ± 8.1	0.76
4 weeks	36.5 ± 7.1	42.5 ± 7.9	<0.001
8 weeks	32.1 ± 6.7	41.9 ± 8.3	<0.0

Time Point	Prenatal Yoga Trait Anxiety (mean \pm SD)	Control Trait Anxiety (mean \pm SD)	p-value (Group \times Time)
Baseline	44.5 ± 7.9	44.8 ± 8.2	0.85
4 weeks	38.2 ± 6.8	44.2 ± 7.6	<0.001
8 weeks	34.7 ± 6.5	43.5 ± 7.8	<0.001

Effect size calculations indicated large reductions in anxiety for the yoga group (Cohen's $d = 1.42$ for state anxiety; 1.18 for trait anxiety), consistent with prior meta-analytic findings demonstrating prenatal yoga's efficacy in anxiety reduction.

3.2 Sleep Quality Outcomes

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), with scores ranging from 0 to 21; scores ≥ 5 indicate poor sleep quality.

At baseline, both groups exhibited poor sleep quality (Yoga: 7.2 ± 1.8 ; Control: 7.1 ± 1.9 ; $p=0.81$). After 8 weeks, the yoga group improved markedly to 4.1 ± 1.2 , indicating good sleep quality, while the control group showed minimal improvement (6.8 ± 2.0 ; $p < 0.001$ for group \times time interaction).

Table 3. Sleep quality scores over time.

Time Point	Prenatal Yoga PSQI (mean \pm SD)	Control PSQI (mean \pm SD)	p-value (Group \times Time)
Baseline	7.2 ± 1.8	7.1 ± 1.9	0.81
4 weeks	5.3 ± 1.4	6.9 ± 2.1	<0.001
8 weeks	4.1 ± 1.2	6.8 ± 2.0	<0.001

The proportion of participants classified as poor sleepers (PSQI ≥ 5) decreased from 78% to 23% in the yoga group, compared to a reduction from 76% to 71% in controls ($p < 0.001$).

Additional secondary outcomes included maternal self-efficacy and pregnancy discomfort scores, both showing significant improvement in the yoga group compared to controls ($p < 0.01$). No adverse events related to the yoga intervention were reported, confirming safety.

3.3. Discussion

This study investigated the effectiveness of prenatal yoga in reducing anxiety and improving sleep quality among pregnant women through a rigorous mixed-methods randomized controlled trial conducted in Indonesia. The findings demonstrated significant improvements in both psychological and physiological outcomes for women participating in an 8-week prenatal yoga program compared to standard antenatal care. This discussion contextualizes these results within the broader literature, explores underlying mechanisms, addresses cultural and clinical implications, acknowledges study limitations, and suggests directions for future research [11].

Interpretation of Quantitative Findings

Anxiety Reduction

The prenatal yoga group showed a statistically and clinically significant reduction in both state and trait anxiety scores over the 8-week intervention period. The effect sizes (Cohen's $d = 1.42$ for state anxiety and 1.18 for trait anxiety) indicate large treatment effects, exceeding the moderate effects reported in many previous studies. For example, a meta-analysis by Field et al. (2012) reported standardized mean differences around 0.5 to 0.8 for anxiety reduction with prenatal yoga, suggesting that the current study's culturally adapted protocol and rigorous implementation may have enhanced efficacy [12].

The substantial anxiety reduction is particularly important given the high prevalence of pregnancy-related anxiety in Indonesia, where up to 72% of pregnant women report symptoms. Anxiety during pregnancy is associated with adverse obstetric outcomes such as preterm birth, low birth weight, and increased cesarean delivery rates. Therefore, effective anxiety reduction interventions like prenatal yoga may contribute to improved maternal and neonatal health outcomes [13].

Improvement in Sleep Quality

Sleep quality improved markedly in the prenatal yoga group, with mean PSQI scores decreasing from 7.2 (indicative of poor sleep) to 4.1 (indicative of good sleep quality) by the end of the intervention. The proportion of poor sleepers dropped from 78% to 23%, a clinically meaningful change. This contrasts with minimal improvement in the control group, where poor sleep prevalence remained above 70%.

These findings align with previous research demonstrating that prenatal yoga can improve sleep quality by reducing insomnia symptoms, increasing total sleep time, and enhancing sleep efficiency. The mechanisms likely involve both physiological relaxation and psychological stress reduction, as poor sleep during pregnancy is often exacerbated by anxiety and physical discomfort [14].

Secondary Outcomes and Safety

Additional improvements in maternal self-efficacy and reductions in pregnancy-related discomfort further support the holistic benefits of prenatal yoga. Importantly, no adverse events were reported, confirming the safety of this intervention when delivered by trained instructors with pregnancy-specific modifications.

Integration with Qualitative Findings

The qualitative data enriched the understanding of how prenatal yoga produced these benefits. Participants described enhanced emotional regulation, physical comfort, mindfulness, social support, and preparation for labor. These themes provide insight into the biopsychosocial mechanisms underlying the quantitative improvements.

Emotional Regulation and Mindfulness

Participants' reports of improved emotional regulation and mindfulness correspond with the observed reductions in anxiety. Yoga's emphasis on breath control, meditation, and present-moment awareness likely enhances parasympathetic nervous system activity and reduces sympathetic arousal, thereby mitigating anxiety symptoms. Mindfulness practices also foster acceptance and nonjudgmental awareness, which can buffer against rumination and worry common in pregnancy-related anxiety [15].

Physical Comfort and Empowerment

The relief from physical discomfort and increased body awareness reported by participants likely contributed to improved sleep quality and overall well-being. Prenatal yoga's gentle stretching and strengthening exercises can alleviate musculoskeletal pain and improve circulation, both of which are common contributors to sleep disturbances during pregnancy. The sense of bodily empowerment may also enhance self-efficacy, promoting greater confidence in managing pregnancy challenges.

Social Support and Community

Group yoga sessions provided social connectedness and peer support, which are important protective factors against perinatal mental health problems. The shared experience of pregnancy and yoga practice created a supportive environment that reduced isolation and fostered positive emotional experiences, potentially amplifying intervention effects.

Preparation for Labor and Motherhood

Participants felt better prepared for labor through breathing and relaxation techniques learned in yoga, which may reduce fear and anxiety related to childbirth. This preparation could have downstream benefits for labor outcomes and postpartum adjustment, although these were not measured in the current study.

Mechanisms of Action

The effectiveness of prenatal yoga can be explained through multiple interrelated physiological and psychological mechanisms:

- **Autonomic Nervous System Regulation:** Yoga activates the parasympathetic nervous system, reducing heart rate, blood pressure, and cortisol levels, which collectively decrease stress and anxiety.
- **Neuroendocrine Modulation:** Regular practice may normalize hypothalamic-pituitary-adrenal axis function, lowering circulating stress hormones that negatively impact sleep and mood.
- **Improved Sleep Architecture:** Relaxation and physical activity components of yoga can enhance sleep onset latency, duration, and efficiency.
- **Psychological Coping:** Mindfulness and meditation improve emotional regulation, reduce catastrophizing, and increase resilience.
- **Social and Behavioral Factors:** Group support and structured routines promote adherence and positive health behaviors.
- These mechanisms operate synergistically, addressing the multifactorial nature of pregnancy-related anxiety and sleep disturbances.

Cultural and Contextual Considerations

This study's setting in Indonesia adds important cultural context to the prenatal yoga literature, which has been predominantly Western-centric. The intervention was culturally adapted, incorporating local language, music, and respect for religious practices, which likely enhanced acceptability and engagement. The high adherence and positive qualitative feedback underscore the feasibility of prenatal yoga in this population.

Indonesia's high maternal mortality and limited mental health resources highlight the urgent need for accessible, low-cost, and culturally appropriate interventions. Prenatal yoga, delivered through community health centers or hospitals, could fill critical gaps in maternal care, especially in resource-constrained settings.

Clinical Implications

The findings support the integration of prenatal yoga into routine antenatal care as a safe and effective complementary therapy for anxiety and sleep disturbances. Healthcare providers should consider recommending prenatal yoga programs led by certified instructors trained in pregnancy modifications.

Implementation requires collaboration between obstetric care providers and yoga practitioners to ensure safety, cultural sensitivity, and continuity of care. Educational materials and training should be developed for healthcare professionals to facilitate referrals and monitor outcomes.

Given the holistic benefits observed, prenatal yoga may also improve other pregnancy-related outcomes such as pain management, physical fitness, and preparation for childbirth, warranting inclusion in comprehensive maternal health strategies.

4. CONCLUSION

This study provides robust evidence that prenatal yoga is an effective, safe, and culturally acceptable intervention for reducing anxiety and improving sleep quality among pregnant women. The large effect sizes observed, combined with rich qualitative insights, underscore the multifaceted benefits of prenatal yoga. These findings have important implications for clinical practice and maternal health policy, particularly in low-resource settings where mental health services are limited. Integrating prenatal yoga into standard antenatal care could improve maternal well-being, pregnancy experiences, and potentially birth outcomes, contributing to healthier mothers and infants. By addressing both psychological and physiological dimensions of pregnancy-related distress, prenatal yoga represents a holistic approach aligned with contemporary models of maternal care. Future research should build on these findings to optimize intervention protocols, expand access, and evaluate long-term impacts.

ACKNOWLEDGEMENTS

Author thanks to all people and institution. In most cases, sponsor and financial support acknowledgments.

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