

Original Research

The Impact of Prenatal Yoga Exercise on the Stress Levels, Psychological Resilience, Distribution of the Second Stage of Labor, and Pregnancy Outcomes in Pregnant Women

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Abstract

Background: Pregnancy presents significant physical, emotional, and psychological challenges for women. Prenatal yoga exercise has been increasingly recognized for its potential to address these aspects of maternal health. However, the specific impact of prenatal yoga exercise remains an area of ongoing investigation. This study aimed to investigate the effects of prenatal yoga exercise on stress levels, psychological resilience, the duration of the second stage of labor, and pregnancy outcomes in pregnant women. Understanding these effects is crucial for improving maternal and neonatal health, as well as informing antenatal care practices. **Methods:** A retrospective cohort study was conducted on expectant mothers admitted to our hospital from January 2023 to June 2023. They were divided into a non-prenatal yoga exercise group ($n = 67$) and a prenatal yoga exercise group ($n = 64$). Prenatal yoga exercise involved a tailored program from the 16th week of pregnancy until delivery. A range of measurements including stress levels, psychological resilience, duration of labor stages, and pregnancy outcomes were assessed. **Results:** Post-intervention stress levels decreased significantly in the prenatal yoga group ($p = 0.018$) compared to the non-prenatal yoga group. Post-intervention psychological resilience scores were higher in the prenatal yoga group ($p = 0.014$) compared to the non-prenatal yoga group. The second stage of labor was shorter in the prenatal yoga group ($p = 0.010$) than in the non-prenatal yoga group. The prenatal yoga group also exhibited lower rates of forceps delivery, episiotomy, oxytocin use, cesarean section, and a higher rate of vaginal delivery, all with significant differences ($p < 0.05$). Significant correlations were found between prenatal yoga and maternal outcomes ($p < 0.05$). **Conclusions:** This study provides insights into potential benefits of prenatal yoga exercise in reducing stress, enhancing psychological resilience, promoting efficient labor progress, and improving pregnancy outcomes.

Keywords: prenatal yoga exercise; stress levels; psychological resilience; pregnancy outcomes; pregnant women

1. Introduction

Pregnancy is a life-altering and often challenging period, involving significant physiological and emotional changes for women [1]. The complex interplay of biological, hormonal, and psychosocial factors during gestation and childbirth underscores the importance of comprehensive support and care for expectant mothers [2–4]. Maternal stress, psychological resilience, labor progression, and pregnancy outcomes are critical aspects of maternal health and obstetric care, each carrying implications for well-being. Therefore, understanding the factors that influence these domains is essential for optimizing the care provided to pregnant women and promoting favorable childbirth experiences.

Prenatal yoga exercise has emerged as a complementary approach to antenatal care, increasingly recognized for its potential to address physical discomfort, psychological distress, and preparation for labor and delivery [5,6]. Yoga, an ancient practice originating from India, encompasses a diverse array of physical postures (asanas), breath-

ing techniques (pranayama), and meditation, with demonstrated benefits for overall well-being and stress management [7]. The therapeutic potential of yoga in the context of pregnancy was of particular interest, given its integrative approach to physical, mental, and emotional health [8]. However, the specific impact of prenatal yoga exercise on maternal stress levels, psychological resilience, labor dynamics, and pregnancy outcomes remains an area of ongoing investigation.

Therefore, this study aimed to examine the impact of prenatal yoga exercise on the aforementioned aspects of maternal health within the context of pregnancy and childbirth. By investigating the associations between prenatal yoga exercise and maternal stress levels, psychological resilience, distribution of the second stage of labor, and pregnancy outcomes, this research sought to elucidate the potential benefits of integrating prenatal yoga exercise into antenatal care.



2. Materials and Methods

2.1 Study Design

This study was a retrospective cohort study. Expectant mothers admitted to Zhuhai People's Hospital from January 2023 to June 2023 were selected and divided into the non-prenatal yoga exercise group ($n = 67$) and the prenatal yoga exercise group ($n = 64$), based on their choice of prenatal yoga exercise. The method of choice for pregnant women involved several steps to ensure that their preferences were respected and considered. Firstly, physicians provided comprehensive information about available treatment options, including their benefits and potential risks, to all pregnant women in a clear and understandable manner, ensuring their full understanding of their choices. Subsequently, pregnant women and physicians jointly made decisions, openly and honestly discussing available treatment options, considering the pregnant women's medical condition, personal values, and preferences. Importantly, all decisions by pregnant women were made within the framework of medical ethics, ensuring that their autonomy and the right to informed consent were effectively upheld throughout the decision-making process.

This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Institutional Review Board of Zhuhai People's Hospital (Ethics Approval Number: ZH20241210).

2.2 Inclusion and Exclusion Criteria

Inclusion criteria: (1) Singleton full-term pregnancy; (2) Normal pelvic size and shape; (3) Normal coagulation function; (4) Normal pre-pregnancy body mass index (BMI); (5) Age between 20 and 35 years; (6) Pregnant women at 12–15 weeks of gestation; (7) Normal mental and cognitive function; (8) Complete medical records.

Exclusion criteria: (1) Tilted or narrow pelvis; (2) Emergency delivery; (3) High-risk pregnant women; (4) Presence of significant bleeding or other risk factors; (5) Pregnancy with other diseases or abnormal conditions; (6) Inability to attend prenatal check-ups and yoga practice sessions as scheduled; (7) Inability to understand or complete the questionnaire.

2.3 Treatment Methods

The no prenatal yoga exercise group received routine health guidance, which involved healthcare providers providing expectant mothers with information on pregnancy guidelines, prenatal check-up schedules, proper diet, and exercise.

The prenatal yoga exercise group received prenatal yoga training starting from the 16th week of pregnancy, in addition to the routine health guidance, until delivery. The yoga sessions were tailored by healthcare providers to match the physiological conditions and specific needs of each expectant mother. The exercises included: (1) Mountain pose training: Expectant mothers were guided to

stand with their feet together, straighten their knees, extend their spine upward, and interlock their hands while stretching upwards. This position was held for approximately two minutes. (2) Triangle stretch training: Participants started in the mountain pose, extended their legs 2–3 times shoulder-width apart, and performed a sequence involving side stretches and arm extensions, maintaining each position for about 1 minute on both sides. (3) Shoulder bridge pose training: Mothers were guided to lie on their backs with knees bent, lifting and lowering their hips while maintaining steady breathing. (4) Abdominal and chest deep breathing training: These exercises focused on controlled breathing techniques, involving deep inhalations and exhalations while lying on their backs with bent knees.

The yoga sessions were conducted in a quiet location with fresh air, and participants were advised to perform the exercises according to their individual capabilities to avoid overexertion.

2.4 Measurement Parameters

All parameters are measured and recorded by a qualified obstetrician and gynecologist. General information about pregnant women was retrieved through a systematic case search, including age, pre-pregnancy BMI, smoking history, alcohol consumption history, hypertension, diabetes, hyperlipidemia, primipara number, pregnancy method, gestational weeks, and education level. The stress levels of pregnant women before and after the intervention were assessed using the Pregnancy Psychological Stress Scale, which consists of 36 items across 5 dimensions: stress related to concerns about the safety of the mother and child throughout the entire pregnancy and delivery, concerns about the ability to care for the child and cope with changes in family relationships, concerns about the ability to fulfill the role of a mother, concerns about receiving social support, and concerns about the physical and bodily changes resulting from pregnancy and childbirth. Each item was scored from 0 to 4, corresponding to “not at all”, “slightly”, “moderately”, “severely”, and “extremely”. The total scale score ranged from 0 to 144, with higher scores indicating higher levels of psychological stress in pregnant women. The Cronbach's α coefficient for the scale was 0.942, and the test-retest reliability was 0.912 [9]. The psychological resilience levels of pregnant women before and after the intervention were measured using the Connor-Davidson Resilience Scale (CD-RISC-10). This scale comprises 10 items, scored from 0 to 4 (from never to always), with a total score of 40; higher scores indicate higher levels of psychological resilience. In this study, Cronbach's α value was 0.891 [10].

2.5 Statistical Methods

Data analysis was conducted using SPSS 29.0 statistical software (SPSS Inc, Chicago, IL, USA). Categorical data were presented in the form of [n (%)] and sub-

jected to Chi-square tests, using the basic formula when the sample size was ≥ 40 and the theoretical frequency T was ≥ 5 . When the sample size was ≥ 40 but the theoretical frequency was $1 \leq T < 5$, the Chi-square test with a correction formula was applied. For sample sizes < 40 or theoretical frequencies $T < 1$, statistical analysis was performed using Fisher's exact probability method. The Shapiro-Wilk method was used to test the normal distribution of continuous variables. For normally distributed continuous variables, they were expressed as mean \pm standard deviation (SD), and the t -test with corrected variance was utilized. A two-tailed $p < 0.05$ was considered statistically significant. Pearson's correlation analysis was used for continuous variables that followed a normal distribution, while Spearman's correlation analysis was applied for continuous variables that did not meet the normal distribution assumption. For categorical variables, including binary variables such as prenatal yoga exercise (Yes/No), Chi-square tests were used to assess group differences. Spearman's correlation analysis was only applied when the variables were ordinal.

3. Results

3.1 Baseline Characteristics

The baseline characteristics of the participants in the no prenatal yoga exercise group ($n = 67$) and the prenatal yoga exercise group ($n = 64$) were compared (Table 1). There were no statistically significant differences between the two groups in terms of age, pre-pregnancy BMI, smoking history, drinking history, hypertension, diabetes, hyperlipidemia, primipara status, pregnancy conception method, gestational week at delivery, and education level (both $p > 0.050$).

3.2 Stress Levels

The stress levels before and after the intervention were compared (Table 2), their values before and after intervention were statistically significant in both the prenatal yoga exercise group and the no prenatal yoga exercise group ($p < 0.0001$). No significant difference has been shown in the pre-intervention stress levels between these two groups ($p = 0.522$). However, the post-intervention stress levels showed a statistically significant decrease in the prenatal yoga exercise group ($p = 0.018$) compared to the no prenatal yoga exercise group.

Table 1. Comparison of baseline characteristics between no prenatal yoga exercise group and prenatal yoga exercise group.

Parameters	No prenatal yoga exercise group (n (%), mean \pm SD, n = 67)	Prenatal yoga exercise group (n (%), mean \pm SD, n = 64)	t/χ^2	p -value
Age (years)	28.45 \pm 2.34	29.12 \pm 2.73	1.511	0.133
Pre-pregnancy BMI (kg/m ²)	24.67 \pm 3.15	25.01 \pm 2.87	0.639	0.524
Smoking history	6 (8.96%)	4 (6.25%)	0.064	0.800
Drinking history	7 (10.45%)	8 (12.50%)	0.136	0.712
Hypertension	6 (8.96%)	4 (6.25%)	0.064	0.800
Diabetes	4 (5.97%)	5 (7.81%)	0.005	0.943
Hyperlipidemia	2 (2.99%)	3 (4.69%)	0.003	0.958
Primipara	46 (68.66%)	46 (71.88%)	0.162	0.687
Pregnancy conception method			0.186	0.666
Natural conception	64 (95.52%)	59 (92.19%)		
Artificial conception	3 (4.48%)	5 (7.81%)		
Gestational weeks at delivery	39.31 \pm 1.52	39.54 \pm 1.34	0.919	0.360
Education level			0.386	0.534
High school or below	20 (29.85%)	16 (25.00%)		
Above high school	47 (70.15%)	48 (75.00%)		

χ^2 , Chi-square; BMI, body mass index; SD, standard deviation.

Table 2. Stress levels before and after intervention.

Parameters	No prenatal yoga exercise group (mean \pm SD, n = 67)	Prenatal yoga exercise group (mean \pm SD, n = 64)	t	p -value
Pre-intervention	120.42 \pm 5.63	121.02 \pm 4.97	0.642	0.522
Post-intervention	105.67 \pm 20.89	96.95 \pm 20.72	2.398	0.018
t	5.641	9.080		
p -value	<0.0001	<0.0001		

SD, standard deviation.

Table 3. Comparison of psychological resilience scores between the no prenatal yoga exercise group and prenatal yoga exercise group.

Parameters	No prenatal yoga exercise group (mean \pm SD, n = 67)	Prenatal yoga exercise group (mean \pm SD, n = 64)	<i>t</i>	<i>p</i> -value
Pre-intervention	25.21 \pm 7.32	26.51 \pm 8.13	0.961	0.338
Post-intervention	31.32 \pm 6.72	34.42 \pm 7.52	2.487	0.014
<i>t</i>	5.218	5.537		
<i>p</i> -value	<0.0001	<0.0001		

SD, standard deviation.

Table 4. Comparison of the duration of the second stage of labor between the no prenatal yoga exercise group and prenatal yoga exercise group.

Parameters	No prenatal yoga exercise group (mean \pm SD, n = 67)	Prenatal yoga exercise group (mean \pm SD, n = 64)	<i>t</i>	<i>p</i> -value
Duration of the first stage of labor	6.15 \pm 1.14	6.21 \pm 1.23	0.285	0.776
Duration of the second stage of labor	42.35 \pm 8.34	38.72 \pm 7.53	2.611	0.010
<i>t</i>	36.20	38.24		
<i>p</i> -value	<0.0001	<0.0001		

SD, standard deviation.

3.3 Psychological Resilience Scores

The psychological resilience scores of the two groups were compared and there was a statistically significant difference in the resilience scores before and after the intervention between the prenatal yoga exercise group and no prenatal yoga exercise group ($p < 0.0001$) (Table 3). There were no statistically significant differences in the pre-intervention scores between the no prenatal yoga exercise group ($p = 0.338$) and the prenatal yoga exercise group (Table 3). However, the post-intervention psychological resilience scores revealed a statistically significant increase in the prenatal yoga exercise group ($p = 0.014$) compared to the no prenatal yoga exercise group.

3.4 Duration of the Second Stage of Labor

The duration of the first stage of labor was not significantly different between the no prenatal yoga exercise group ($p = 0.776$) and the prenatal yoga exercise group (Table 4). However, the duration of the second stage of labor was significantly shorter in the prenatal yoga exercise group ($p = 0.010$) compared to the no prenatal yoga exercise group. Furthermore, the difference in the duration of the first stage of labor and the second stage of labor within the two groups was also significant ($p < 0.0001$). These findings suggest that prenatal yoga exercise may be associated with a reduction in the duration of the second stage of labor in pregnant women.

3.5 Pregnancy Outcome

The prenatal yoga exercise group demonstrated lower rates of forceps delivery ($p = 0.020$), episiotomy ($p = 0.016$), use of oxytocin ($p = 0.019$), and cesarean section ($p = 0.030$) compared to the no prenatal yoga exercise group

(Table 5). Additionally, the prenatal yoga exercise group presented a higher rate of vaginal delivery ($p = 0.030$).

3.6 Correlation Analysis

In the correlation analysis of prenatal yoga exercise with maternal stress levels, psychological resilience, second stage of labor distribution, and pregnancy outcome, statistically significant correlations were observed (Table 6). Prenatal yoga exercise demonstrated a negative correlation with post-intervention stress levels ($r = -0.207$, $R^2 = 0.043$, $p = 0.018$) and with the duration of the second stage of labor ($r = -0.224$, $R^2 = 0.051$, $p = 0.010$). Additionally, a positive correlation was found between prenatal yoga exercise and post-intervention psychological resilience ($r = 0.214$, $R^2 = 0.046$, $p = 0.014$).

4. Discussion

The impact of prenatal yoga exercise on the stress levels, psychological resilience, distribution of the second stage of labor, and pregnancy outcomes in pregnant women is an important area of study with potential implications for both maternal and neonatal health [11–13]. This retrospective cohort study aimed to investigate the effects of prenatal yoga exercise on these critical aspects of pregnancy. The findings of this study provide valuable insights into the potential benefits of incorporating prenatal yoga exercise as part of routine antenatal care.

The results of this study demonstrate a significant reduction in post-intervention stress levels and an increase in psychological resilience among pregnant women who participated in prenatal yoga exercise. These findings were consistent with previous research [14,15], indicating that yoga practice can lead to improvements in psychologi-

Table 5. Comparison of pregnancy outcome between the no prenatal yoga exercise group and prenatal yoga exercise group.

Parameters	No prenatal yoga exercise group (n (%), n = 67)	Prenatal yoga exercise group (n (%), n = 64)	χ^2	p-value
Forceps delivery	18 (26.87%)	7 (10.94%)	5.378	0.020
Episiotomy	17 (25.37%)	6 (9.38%)	5.788	0.016
Use of oxytocin	45 (67.16%)	30 (46.88%)	5.506	0.019
Cesarean section	30 (44.78%)	17 (26.56%)	4.720	0.030
Vaginal delivery	37 (55.22%)	47 (73.44%)	4.720	0.030

χ^2 , Chi-square.

Table 6. Correlation analysis of prenatal yoga exercise with maternal stress levels, psychological resilience, second stage of labor distribution, and pregnancy outcome.

	r	R ²	p
Post-intervention stress	-0.207	0.043	0.018
Post-intervention resilience	0.214	0.046	0.014
Second stage of labor (minutes)	-0.224	0.051	0.010

cal well-being and stress management. The incorporation of mindfulness-based techniques, breathing exercises, and physical activity in prenatal yoga may contribute to these observed benefits. Mindfulness-based interventions have been previously shown to reduce perceived stress and enhance psychological resilience in pregnant women, which aligns with the outcomes of this study [16,17]. Furthermore, the positive effects of yoga on mental health and well-being have been documented across various populations, underscoring its potential as a holistic approach to supporting psychological health during pregnancy [18–20]. Prenatal yoga practice often incorporates elements of mindfulness, deep breathing, and relaxation techniques. Engaging in these practices can activate the parasympathetic nervous system, leading to a reduction in stress-related hormones, such as cortisol and an enhancement of the relaxation response. This physiological relaxation response may contribute to decreased perceived stress, improved emotional well-being, and an overall reduction in the physiological impact of stress on the body during pregnancy and labor [21,22].

The observed increase in psychological resilience among pregnant women engaging in prenatal yoga exercise was particularly noteworthy. Psychological resilience was a vital factor in coping with the challenges of pregnancy, childbirth, and the postpartum period [23]. Enhancing psychological resilience can potentially alleviate the impact of stressors and promote adaptive responses to the demands of pregnancy and motherhood. The findings of this study suggest that prenatal yoga exercise may serve as a valuable adjunctive intervention to promote maternal psychological well-being and resilience during the perinatal period.

Another significant outcome of this study was the association between prenatal yoga exercise and a shorter duration of the second stage of labor. The shorter duration of the second stage of labor in the prenatal yoga exercise group

may have potential implications for maternal and neonatal health. Prolonged second stage of labor was associated with increased risks of maternal exhaustion, perineal trauma, and the need for instrumental delivery. The potential impact of prenatal yoga exercise on expediting the second stage of labor aligns with the concept of physical preparedness and relaxation techniques inherent in yoga practice [24,25]. The incorporation of specific yoga poses and breathing exercises, targeted at pelvic floor relaxation, optimal fetal positioning, and controlled pushing, may contribute to the observed reduction in the duration of the second stage of labor [26]. The physical postures and movements involved in prenatal yoga exercises are designed to promote strength, flexibility, and awareness of the pelvic floor and surrounding musculature [27]. This targeted conditioning of the pelvic floor muscles and increased body awareness may support optimal positioning of the fetus and facilitate efficient engagement and descent of the baby during labor. Enhanced pelvic floor tone and control have been associated with more effective pushing efforts and potentially shorter durations of the second stage of labor. This finding suggests that prenatal yoga exercise could be considered as a non-pharmacological approach to support efficient labor progression, potentially reducing the need for obstetric interventions, thus enhancing the overall childbirth experience for women.

Furthermore, the favorable pregnancy outcomes associated with prenatal yoga exercise in this study were noteworthy. The lower rates of forceps delivery, episiotomy, use of oxytocin, and cesarean section, coupled with a higher rate of vaginal delivery, indicate potential benefits of prenatal yoga exercise in reducing the need for obstetric interventions, supporting physiological childbirth. These results were consistent with previous studies [28,29], which reported favorable pregnancy outcomes among women who engaged in yoga during pregnancy. The potential role of

prenatal yoga exercise in promoting vaginal delivery and reducing the incidence of obstetric interventions was significant, given the broader emphasis on promoting physiological birth and reducing unnecessary medicalization of childbirth [30]. The findings from our study add to the body of evidence supporting the potential role of yoga-based interventions in optimizing pregnancy and birth outcomes.

The correlation analysis conducted in this study provides insights into the relationships between prenatal yoga exercise and various maternal outcomes. The negative correlation between prenatal yoga exercise and post-intervention stress levels, as well as the duration of the second stage of labor, suggests that active participation in prenatal yoga may contribute to mitigating stress levels and potentially promoting efficient labor progress. Additionally, the positive correlation with post-intervention psychological resilience further emphasizes the potential psychosocial benefits of prenatal yoga exercise [31]. These correlations underscore the multifaceted impact of prenatal yoga exercise on maternal well-being and childbirth experiences.

While this study provides valuable insights into the potential benefits of prenatal yoga exercise, several limitations should be acknowledged. First, the retrospective nature of the study design may introduce inherent biases and limitations in data collection. Additionally, the sample size, while sufficient for the analyses conducted, may limit the generalizability of the findings. The low R^2 value observed in the correlation analysis may reflect the inherent complexity of the relationship between the variables, where multiple unmeasured factors or non-linear dynamics could play a significant role. Moreover, the study did not incorporate long-term follow-up to assess postpartum outcomes and maternal mental health beyond the immediate post-intervention period, which represents an area for future investigation. Furthermore, while efforts were made to control for confounding variables, the potential influence of unmeasured factors, high data variability, and noise cannot be entirely ruled out, which may have contributed to the reduced explanatory power of the model. These limitations underscore the need for further prospective controlled studies to validate and expand upon the findings of this research.

5. Conclusions

The findings of this study suggest that prenatal yoga exercise was associated with improved stress management, psychological resilience, efficient labor progress, and favorable pregnancy outcomes. These results contribute to the growing body of evidence supporting the potential benefits of integrating prenatal yoga exercise into antenatal care. Further research and concerted efforts to integrate evidence-based prenatal yoga interventions into maternity care have the potential to positively impact maternal and neonatal health outcomes.

Availability of Data and Materials

The data involved in the present study can be provided under reasonable request.

Author Contributions

All authors contributed to the study conception and design. Material preparation, data collection and data analysis were performed by JJ, JT, XZ and DHY. The first draft of the manuscript was written by JT, XZ and DHY. QY and XMD commented and revised previous versions of the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was carried out in accordance with the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of Zhuhai People's Hospital (Ethics Approval Number: ZH20241210) in accordance with regulatory and ethical guidelines. Informed consent was waived for this study due to the exclusive use of de-identified patient data, which posed no potential harm or impact on patient care.

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Conflict of Interest

The authors declare no conflict of interest.

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