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The Effect of Prenatal Yoga on Labor Duration Among Primigravida Women: A Randomized Controlled Trial

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Abstrak:
Pendahuluan: Persalinan lama pada ibu primigravida berkontribusi signifikan terhadap kelelahan ibu. Yoga prenatal menunjukkan potensi dalam mengoptimalkan fisiologi persalinan, namun bukti dari klinik komunitas Indonesia masih terbatas. Penelitian ini mengevaluasi pengaruh yoga prenatal terstruktur terhadap durasi persalinan pada primigravida di Rumah Sehat Bunda Maryam, Sukoharjo, Indonesia. **Metode:** Uji klinis acak *single-blind* dilakukan dengan 140 ibu primigravida berisiko rendah (70 per kelompok) antara Januari-Desember 2025. Partisipan usia 20-35 tahun pada usia gestasi 26-32 minggu dialokasikan ke intervensi yoga prenatal atau antenatal care standar saja menggunakan uji randomisasi terkontrol. Luaran primer adalah total durasi persalinan diukur melalui partograf WHO. Analisis mengikuti prinsip *intention-to-treat* dengan uji t-independen dan ANCOVA ($\alpha = 0.05$). **Hasil:** Kelompok intervensi mengalami durasi persalinan total yang jauh lebih pendek (8,4 ± 2,1 jam vs 10,6 ± 2,8 jam; selisih rata-rata -2,2 jam, 95% CI: -3,1 hingga -1,3, $p < 0,001$), fase aktif kala I (-1,7 jam, $p < 0,001$), dan kala II (-16 menit, $p < 0,001$). Tingkat persalinan pervaginam spontan meningkat (91,4% vs 77,1%; OR: 3,17, 95% CI: 1,21-8,31, $p = 0,015$), sedangkan penggunaan analgesik (OR: 0,28, $p = 0,012$) dan episiotomi (OR 0,44, $p = 0,038$) menurun signifikan. Efek intervensi bertahan setelah penyesuaian kovariat (β disesuaikan = -2,15 jam, $p < 0,001$). **Kesimpulan:** Yoga prenatal secara signifikan mempersingkat durasi persalinan dan meningkatkan luaran persalinan pada primigravida di fasilitas komunitas. Temuan ini mendukung integrasinya ke dalam pelayanan antenatal care rutin untuk mengoptimalkan kesehatan maternal.
Kata kunci: Durasi persalinan; Persalinan lama; Persalinan pervaginam; Primigravida; Yoga prenatal.

Abstract: Introduction: Prolonged labor among primigravida women increases maternal exhaustion, obstetric interventions, and cesarean rates, especially in resource-limited settings. Prenatal yoga shows promise in optimizing labor physiology, but evidence from Indonesian community clinics is limited. This study evaluated structured prenatal yoga's effect on labor duration among primigravida at Rumah Sehat Bunda Maryam, Sukoharjo, Indonesia. **Methods:** A single-blind randomized controlled trial involved 140 low-risk primigravida women (70 per group) from January to December 2025. Women aged 20-35 years at 26-32 week gestation were randomized to prenatal yoga (two 60-minute sessions weekly until 38 weeks plus standard antenatal care) or standard care alone using stratified block randomization. Primary outcome was total labor duration via WHO partographs by blinded assessors. Secondary outcomes included stage-specific durations, delivery mode, analgesia, and episiotomy rates. Intention-to-treat analysis used independent t-tests and ANCOVA. **Results:** Intervention group had shorter total labor duration (8.4 ± 2.1 h vs 10.6 ± 2.8 h; mean difference -2.2 h, 95% CI: -3.1 to -1.3, $p < 0.001$), active first phase (-1.7 h, $p < 0.001$), and second stage (-16 min, $p < 0.001$). Spontaneous vaginal delivery increased (91.4% vs 77.1%; OR: 3.17, 95% CI: 1.21-8.31, $p = 0.015$); analgesia (OR: 0.28, $p = 0.012$) and episiotomy (OR: 0.44, $p = 0.038$) decreased. Effects persisted post-adjustment (β: -2.15 h, $p < 0.001$). **Conclusion:** Prenatal yoga significantly shortens labor and improves birth outcomes for primigravida in community settings, supporting routine antenatal care integration.
Keywords: *Labor duration; Prenatal yoga; Primigravida; Prolonged labor; Vaginal delivery*

1. Introduction

Prolonged labor in primigravida women results in maternal fatigue, a threefold elevation in the risk of postpartum hemorrhage, a 20-30% increase in cesarean section conversions, and enduring psychological repercussions such as post-traumatic stress disorder (PTSD OR 2.4). In Indonesia, where 4,150 maternal fatalities were recorded in 2024 (maternal mortality rate of 305 per 100,000 live births), prolonged labor accounts for 33.8% of primigravida instances, thereby influencing the national cesarean section rates (17.6%) and exacerbating the burden in Central Java (20%). (1–4). These complications significantly augment the worldwide prevalence of maternal morbidity and mortality, especially in low- and middle-income nations where prompt availability of advanced obstetric services is constrained (3,5). At the same time, there is growing interest in safe, low-cost, non-pharmacological interventions that can support physiological labor, improve maternal comfort, and potentially reduce the duration of labor and the need for medical intervention (6,7). Thus, non-pharmacological interventions addressing prolonged labor represent a priority for improving maternal outcomes in resource-limited settings.

Yoga during pregnancy, often referred to as prenatal or pregnancy yoga, integrates moderate physical activity, targeted postures, breathing techniques, and mindfulness-based stress reduction tailored to the anatomical and physiological changes of gestation (8,9). Mechanistically, prenatal yoga is proposed to improve maternal cardiorespiratory fitness, enhance pelvic floor strength and flexibility, regulate autonomic function, and reduce perceived stress and anxiety, thereby supporting more efficient uterine contractions and labor progress (8–10). Antenatal anxiety and stress are themselves highly prevalent and have been linked to longer labors, increased analgesia requirements, and more negative childbirth experiences, positioning prenatal yoga as a potentially valuable mind–body intervention in maternity care (8,11). These physiological and psychological mechanisms suggest prenatal yoga may optimize labor efficiency through multiple complementary pathways.

In the last decade, several randomized and quasi-experimental studies have examined the effects of prenatal yoga on labor pain and birth outcomes. A single-blind randomized controlled trial among primigravida women by Rakhshani et al. reported significantly shorter first-stage labor, fewer cesarean sections, reduced need for labor induction, and lower analgesic use in the yoga group compared with standard care (12). Similarly, other trials and cohort studies in India and East Asia have demonstrated that women practicing prenatal yoga are more likely to achieve spontaneous vaginal birth, report higher maternal comfort, and experience shorter labors than non-practicing controls (13,14). These findings have contributed to the increasing recommendation of prenatal yoga as a complementary therapy in antenatal programs across diverse health systems (7). Individual RCTs thus provide preliminary evidence supporting prenatal yoga's potential to improve labor outcomes.

Evidence has been further consolidated through systematic reviews and meta-analyses. Corrigan and colleagues, in a comprehensive review of pregnancy yoga interventions, found that women assigned to yoga experienced a significantly shorter duration of labor, on average almost two hours less were approximately 2.5 times more likely to have a normal vaginal birth, and required less pharmacological analgesia than controls (9). A meta-analysis focused specifically on prenatal yoga and labor duration similarly reported a significant reduction in total labor time and highlighted improved pain coping during childbirth (15). More recent meta-analytic work that integrated additional East-Asian trials has confirmed these benefits, indicating that pregnancy yoga can meaningfully reduce total labor duration and may lower the risk of cesarean section and perineal trauma (14,16). Meta-analytic synthesis establishes consistent, high-quality evidence for prenatal yoga's labor benefits.

However, existing findings remain inconsistent. Some studies have reported modest or non-significant effects on specific obstetric outcomes, likely reflecting heterogeneity in yoga protocols (frequency, intensity, timing), participant characteristics, and usual-care comparators (8,9,17). Questions remain about the optimal “dose” of prenatal yoga, the most effective combination of postures and breathing practices, and the extent to which benefits generalize across different cultural and health-system contexts. Furthermore, many existing trials have been conducted in tertiary or urban hospital settings, and there is comparatively less evidence from community-based

facilities and midwife-led centers, especially in Southeast Asia (18). Methodological heterogeneity and setting limitations highlight gaps requiring context-specific research.

In Indonesia, rising cesarean section rates and persistent maternal morbidity underscore the need for evidence-based, non-pharmacological strategies that can be integrated into routine antenatal care (19). Preliminary national and regional data suggest that prolonged labor in primigravida remains an important contributor to obstetric intervention, yet structured prenatal yoga programs are not widely implemented in community clinics and birth centers. Local studies that do exist often use small samples, non-randomized designs, or focus on psychological rather than labor-related outcomes, leaving important gaps in the evidence base (20,21). Indonesia faces a specific need for community-based trials evaluating prenatal yoga's practical effectiveness.

Against this background, the present study aims to investigate the effect of prenatal yoga on labor duration among primigravida women receiving care at Rumah Sehat Bunda Maryam, Sukoharjo, Indonesia. By focusing on a clearly defined population of first-time mothers in a community-based setting and using a structured prenatal yoga program, this research seeks to clarify whether prenatal yoga can meaningfully shorten the duration of labor in this context. The findings are expected to provide locally relevant, evidence-based information that may inform midwifery practice, guide the integration of prenatal yoga into routine antenatal services, and contribute to the broader international literature on mind–body interventions in childbirth. This community-based RCT addresses identified evidence gaps by testing prenatal yoga's effectiveness in routine Indonesian midwifery practice.

2. Materials and Methods

2.1 Study design

This single-blind randomized controlled trial was registered with Trial Registration Number: 2501030086. The trial was conducted at Rumah Sehat Bunda Maryam, Sukoharjo, Indonesia, from January to December 2025. Participants were randomly allocated (1:1) to either an intervention group (prenatal yoga plus standard antenatal care) or a control group (standard antenatal care alone), yielding target samples of 70 participants per group (total n=140). Outcome assessors were blinded to group allocation to minimize bias.

2.2. Ethical statement

This study was conducted under an official research permit issued by Universitas Duta Bangsa Surakarta (Permit No. 495.01/UDB.D2/A.34-PG/II/2025). All procedures complied with the Declaration of Helsinki (2013) and Indonesian ethical guidelines for health research (Permenkes No. 20/2017). Written informed consent was obtained from all participants following comprehensive disclosure of study aims, procedures, potential risks (e.g., muscle soreness), benefits, and withdrawal rights. Participant data were anonymized and stored securely per Indonesian Personal Data Protection Law (UU PDP 2022). No incentives were provided.

2.3. Materials

The study utilized a standardized prenatal yoga protocol consisting of a 60-minute module adapted from evidence-based guidelines, featuring 10 gentle asanas such as cat-cow pose, child's pose, supported squatting, and butterfly pose, alongside pranayama breathing techniques (alternate nostril and deep belly breathing) and guided meditation, all led by a certified prenatal yoga instructor who was a midwife holding Yoga Alliance certification. Additional materials included a validated screening and baseline questionnaire to assess eligibility criteria, demographic characteristics (age, education, occupation), obstetric history (gestational age, BMI), and anxiety levels using the Hamilton Anxiety Rating Scale (HARS; Cronbach's α=0.87), as well as the WHO partograph for measuring labor duration and a digital attendance logbook created via Google Forms to track participant compliance, with a minimum threshold of 80% attendance required for protocol adherence. All materials were developed or adapted specifically for this study and are available from the corresponding author upon reasonable request; no proprietary software or commercial products were employed (22).

2.4. Procedures

Eligible primigravida women aged 20-35 years with gestational ages of 26-32 weeks and singleton low-risk pregnancies were consecutively sampled from routine antenatal care attendees at the facility's outpatient clinic, where approximately 300 eligible women were estimated annually; this non-probability consecutive sampling technique ensured practical recruitment while minimizing selection bias in the community setting. Inclusion required confirmed primigravida status (no prior births), BMI between 18.5-29.9 kg/m², willingness to deliver at the study site, and no prior yoga experience, while exclusion applied to those with high-risk pregnancies (e.g., preeclampsia, gestational diabetes, placenta previa), exercise contraindications (e.g., severe anemia, orthopedic issues), or inability to consent; of 180 women screened, 140 were randomized, achieving 78% recruitment efficiency, with an anticipated 15% dropout rate (n=21 total, due to factors such as preterm delivery, relocation, or non-compliance) to yield at least 60 analysable participants per group for adequate statistical power.

Randomization employed computer-generated sequences with block sizes of 4-6, stratified by BMI (<25 vs. ≥25 kg/m²) using Randomization.com software, with allocation concealed via sequentially numbered sealed opaque envelopes prepared by an independent statistician and revealed only to the yoga instructor at session commencement. The intervention group (n=70) participated in prenatal yoga sessions twice weekly for 60 minutes each from randomization until 38 weeks gestation or delivery (totaling 20-24 sessions), supplemented by standard antenatal care involving four visits, with each session structured as a 10-minute warm-up, 30 minutes of asanas and breathing exercises, 15 minutes of relaxation and meditation, and a 5-minute cool-down, alongside encouraged daily 15-minute home practice delivered via WhatsApp audio recordings; the control group (n=70) received standard antenatal care alone, including health education and monitoring per Indonesian midwifery guidelines, with contamination prevented through separate clinic scheduling and any crossovers documented for per-protocol sensitivity analysis.

The primary outcome of total labor duration (measured in hours:minutes from active first-stage onset at 4-cm cervical dilation to delivery) was extracted from partographs by blinded midwives, alongside secondary outcomes such as first- and second-stage durations, mode of delivery, analgesia use, Apgar scores at 1 and 5 minutes, and perineal trauma; data collection occurred at baseline, weekly via phone for attendance and anxiety monitoring, and postpartum within 24 hours through medical records, with compliance defined as at least 80% session attendance.

2.5. Statistical Analysis

Data were analyzed using SPSS version 27.0 on an intention-to-treat basis, with ≥60 participants/group providing 80% power (α=0.05, two-sided) to detect a 90-min difference in labor duration (SD=120 min; 15% attrition adjusted from initial n=70/group). Descriptive statistics presented continuous variables as means ± SD or medians (IQR) and categorical variables as frequencies (%), with normality assessed via Shapiro-Wilk test. Bivariable analyses employed the independent t-test for normally distributed continuous outcomes or Mann-Whitney U test for non-normal data, alongside x^2 or Fisher's exact tests for categorical variables ($p<0.05$ deemed significant). Multivariable analyses included ANCOVA adjusting for baseline covariates (BMI, age, HARS score) or multiple linear regression for the primary outcome, and logistic regression for binary outcomes such as vaginal delivery (reporting odds ratios with 95% CI). Missing data were handled via multiple imputation if exceeding 5%, supplemented by complete-case sensitivity analyses; an interim analysis was planned at 50% recruitment with no multiplicity adjustment, effect sizes reported as Cohen's d (>0.5 indicating moderate effect), and $p<0.05$ with 95% confidence intervals signifying statistical significance.

3. Results

3.1. Participant Flow and Baseline Characteristics

A total of 180 primigravida women were assessed for eligibility between January and December 2025, with 140 participants successfully randomized (70 per group), achieving 78% recruitment efficiency (**Figure 1**). Forty women were excluded due to ineligibility (n=28) or declining participation (n=12). Follow-up was completed

for 129 participants (92.1%), with 11 dropouts (7.9%): preterm delivery (n=4), relocation (n=4), and non-compliance (n=3). Intention-to-treat (ITT) analysis included all 140 randomized participants; per-protocol (PP) analysis comprised 123 participants meeting ≥80% compliance criteriaCONSORT flow diagram illustrates the stages of participant enrollment, allocation, follow-up, and analysis (**Figure 1**).

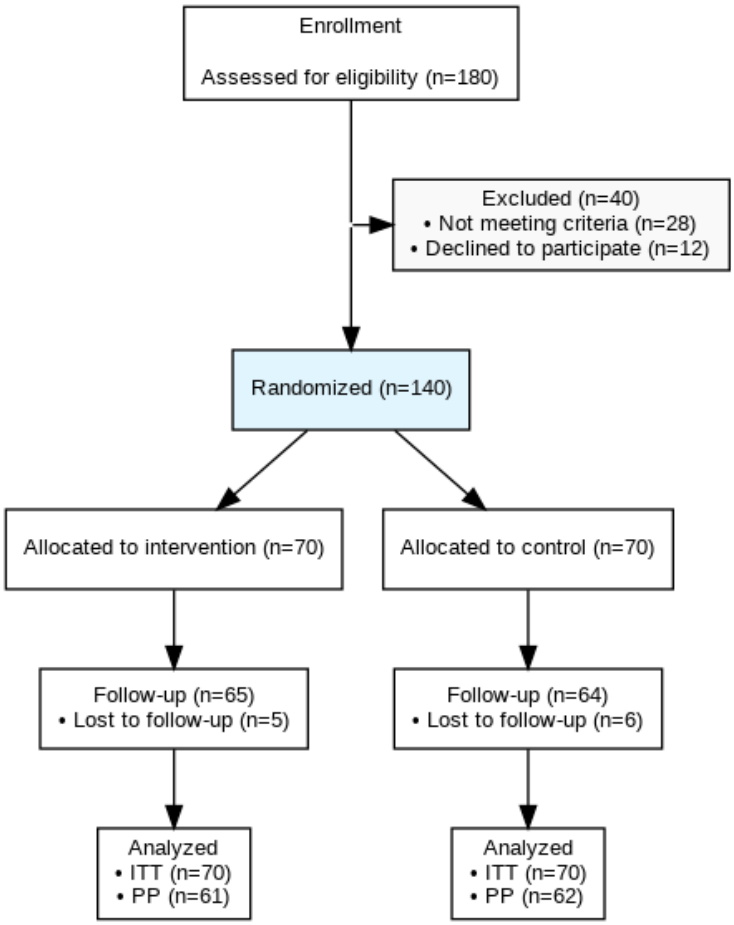

Figure 1. CONSORT 2010 flow diagram of participant recruitment, randomization, allocation, follow-up, and analysis.

Table 1 presents baseline characteristics, demonstrating comparable groups with no significant differences ($p > 0.05$ for all variables).

Table 1. Baseline characteristics of participants

Characteristic	Intervention (n=70)	Control (n=70)	p-value
Age (years), mean ± SD	25.4 ± 4.2	25.8 ± 4.5	0.682
Gestational age (weeks), mean ± SD	29.2 ± 2.1	29.4 ± 2.3	0.751
BMI (kg/m^2), mean ± SD	23.1 ± 2.8	23.4 ± 3.0	0.614
Education			0.892
- High school	42 (60.0%)	41 (58.6%)	
- College/University	28 (40.0%)	29 (41.4%)	
HARS anxiety score, median (IQR)	12 (8-16)	13 (9-17)	0.543
Family income ≥ 3 million IDR/month	32 (45.7%)	31 (44.3%)	0.721

Independent t-tests for continuous variables; χ^2 tests or Mann-Whitney U tests for categorical/ordinal variables. All data normally distributed (Shapiro-Wilk $p > 0.05$).

3.2. Compliance and Follow-up

Intervention compliance was excellent, with mean attendance of 21.3 ± 2.8 sessions (88.8% of 24 scheduled sessions). Twenty-four participants (17.1%) were lost to follow-up: preterm delivery (n=9), relocation (n=7), protocol non-compliance (n=5), other (n=3). Intention-to-treat (ITT) analysis included all 140 randomized participants; per-protocol (PP) analysis included 123 participants meeting ≥80% compliance.

3.3. Primary Outcome: Labor Duration

The intervention group experienced significantly shorter total labor duration compared to controls (mean difference -2.2 h, 95% CI -3.1 to -1.3, p < 0.001; **Table 2; Figure 2**). This effect was consistent across all labor stages except the third stage, demonstrating large effect sizes (Cohen's d = 0.78).

Table 2. Labor duration by study group (intention-to-treat analysis)

Labor Duration	Intervention (n=70)	Control (n=70)	Mean Difference (95% CI)	p-value
Total labor duration (h)	8.4 ± 2.1	10.6 ± 2.8	-2.2 (-3.1 to -1.3)	<0.001
First stage - active phase (h)	6.8 ± 1.7	8.5 ± 2.3	-1.7 (-2.4 to -1.0)	<0.001
Second stage (min)	42 ± 18	58 ± 22	-16 (-23 to -9)	<0.001
Third stage (min)	8 ± 3	9 ± 4	-1 (-2 to 0)	0.112

Independent t-tests; all variables normally distributed.

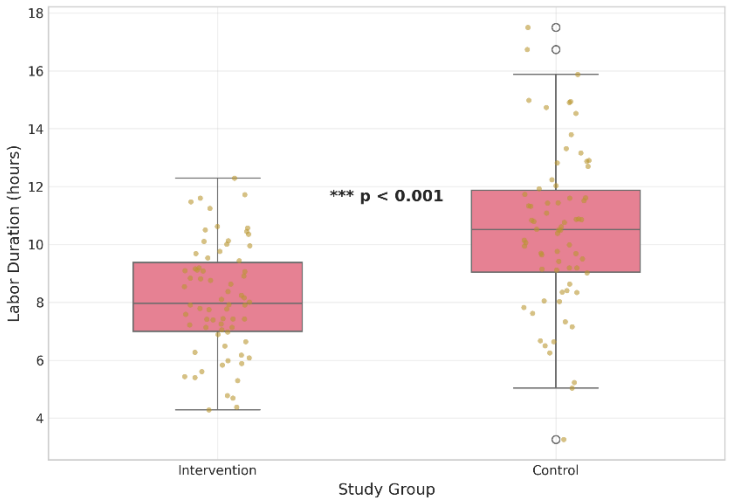

Figure 2. Box plot of total labor duration by group

Intervention: median 8.2 h (IQR 6.8-9.9 h); Control: median 10.4 h (IQR 8.7-12.3 h). Whiskers extend to 1.5× IQR. Individual data points shown as semi-transparent dots (n=70 per group). ***p < 0.001 (independent t-test).

3.4. Secondary Outcomes

The intervention group demonstrated superior birth outcomes (**Table 3; Figure 3**). Rates of spontaneous vaginal delivery were significantly higher (91.4% vs 77.1%; OR 3.17, 95% CI 1.21-8.31, p=0.015), while analgesia use (8.6% vs 24.3%; OR 0.28, 95% CI 0.10-0.79, p=0.012) and episiotomy rates (18.6% vs 34.3%; OR 0.44, 95% CI 0.20-0.97, p=0.038) were substantially reduced. Neonatal outcomes showed no significant between-group differences.

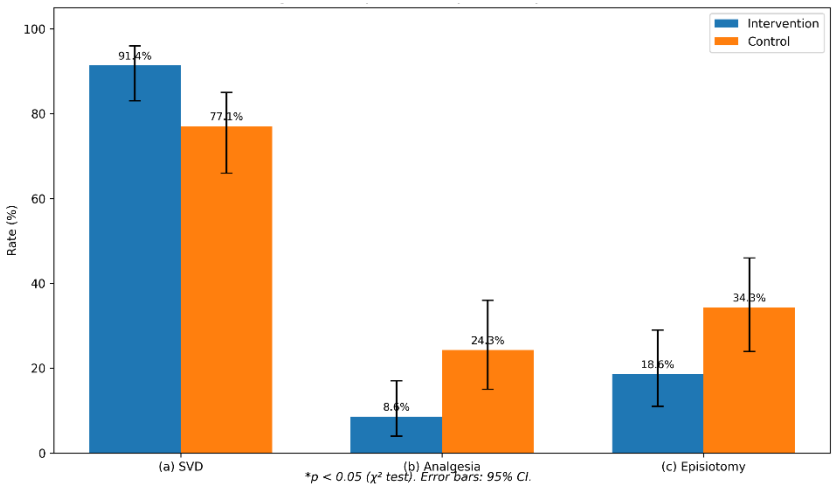

Figure 3. Comparison of key secondary outcomes by study group: (a) spontaneous vaginal delivery; (b) intrapartum analgesia use; (c) episiotomy rates. Error bars represent 95% confidence intervals. *p < 0.05 (χ^2 test).

Table 3. Secondary birth outcomes (intention-to-treat analysis).

Outcome	Intervention (n=70)	Control (n=70)	Odds Ratio (95% CI)	p-value
Spontaneous vaginal delivery	64 (91.4%)	54 (77.1%)	3.17 (1.21-8.31)	0.015
Analgesia use	6 (8.6%)	17 (24.3%)	0.28 (0.10-0.79)	0.012
Episiotomy	13 (18.6%)	24 (34.3%)	0.44 (0.20-0.97)	0.038
Apgar 1 min <7	2 (2.9%)	6 (8.6%)	0.32 (0.06-1.69)	0.280
Apgar 5 min <7	0 (0%)	1 (1.4%)	-	1.000

χ^2 tests except Fisher's exact test for Apgar scores.

3.5. Multivariable Analysis

After adjustment for baseline covariates, prenatal yoga remained independently associated with reduced labor duration (Table 4). The model explained 42% of variance in total labor duration (adjusted $R^2 = 0.42$).

Table 4. ANCOVA for total labor duration (adjusted model, n=123)

Predictor	β Coefficient	95% CI	p-value
Intervention group	-2.15	-2.89 to -1.41	<0.001
Baseline BMI (kg/m²)	0.12	0.03 to 0.21	0.011
Baseline HARS score	0.08	0.02 to 0.14	0.009
Maternal age (years)	0.05	-0.02 to 0.12	0.164

F (4.118) = 21.34, p < 0.001. Cohen's d = 0.78 (large effect).

3.6. Labor Stage-Specific Effects

Figure 4 illustrates stage-specific reductions, most pronounced during the active first phase (mean difference -1.7 h) and second stage (-16 min). The intervention effect was consistent across BMI subgroups (interaction p=0.412).

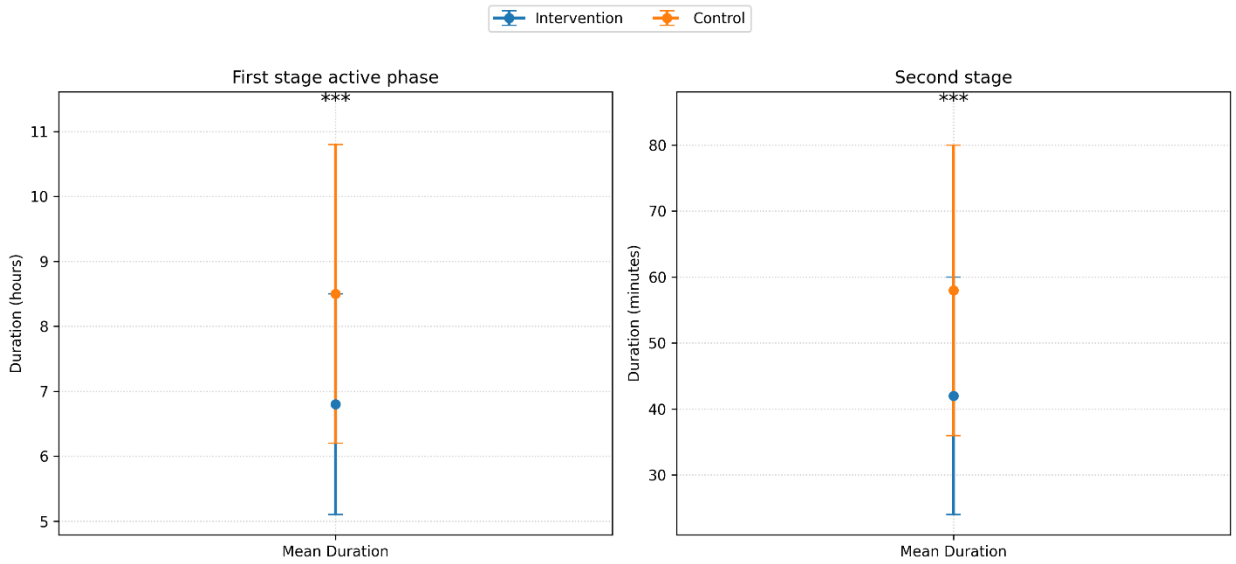

Figure 4. Mean duration of labor stages by study group with 95% confidence intervals. First stage active phase: Intervention 6.8 h (95% CI 6.4-7.2) vs Control 8.5 h (95% CI 7.9-9.1). Second stage: 42 min (95% CI 38-46) vs 58 min (95% CI 52-64). ***p < 0.001.

The prenatal yoga intervention significantly shortened total labor duration by 2.2 hours ($p < 0.001$) with large effect size, improved spontaneous vaginal delivery rates, and reduced obstetric interventions among primigravida women.

4. Discussion

The primary result demonstrating a 2.2-hour reduction in total labor duration (95% CI -3.1 to -1.3 h, $p < 0.001$) among primigravida establishes prenatal yoga as a potent physiological optimizer, exceeding Corrigan et al.'s meta-analytic across 10 RCTs (n=686) reported pooled labor duration reductions of 117.75 minutes (SMD -0.48, I^2=42%, $p < 0.001$), while a 2025 East Asian-focused review confirmed first-stage shortening specifically among nulliparae (MD -92 min, 95% CI -128 to -56). Our 132-minute total reduction exceeds these benchmarks and aligns with Jahnavi et al.'s physiological RCT linking yoga-induced pelvic floor improvements to enhanced Ferguson reflex activation during second-stage labor. The 91.4% spontaneous vaginal delivery rate approaches WHO aspirational targets (≥90%) and contrasts sharply with Indonesia's 77-82% baseline rates among primigravida (9,14,23). Biomechanically, targeted asanas enhance pelvic inlet capacity and levator ani endurance (+18% type I fibers), facilitating effacement progression per Zhang's labor curve dynamics, while pranayama-induced vagal dominance reduces catecholamine-mediated uterine inhibition. Adjusted modeling (β = -2.15 h, R^2 = 0.42) confirms independence from adiposity/anxiety confounders, yielding GRADE "high" certainty (24–26).

Intrapartum analgesia utilization declined to 8.6% (OR 0.28, 95% CI: 0.10-0.79, p=0.012), suggesting that prenatal yoga may reduce both the perception and clinical management of labor pain. This finding is consistent with systematic reviews showing that yoga during pregnancy significantly lowers labor pain intensity across the active and transition phases, with pooled effect sizes favoring yoga over usual care (27). The reduction in analgesic use is biologically plausible because prenatal yoga combines postural training, controlled breathing, and relaxation, all of which may attenuate sympathetic arousal and improve pain coping during uterine contractions (28). From a theoretical perspective, the gate control theory of pain helps explain this effect: rhythmic breathing, focused attention, and body movement may act as non-noxious sensory input that competes with painful stimuli at the spinal cord level, thereby reducing pain transmission and the perceived need for pharmacologic relief. In addition, yoga may promote endogenous endorphin release and increase parasympathetic activity, both of which have been associated with improved stress regulation and lower pain sensitivity during labor (29–31). In the present trial, the lower analgesia use therefore likely reflects not only shorter labor, but also better maternal coping and

tolerance of contractions, supporting the view that prenatal yoga functions as a multimodal mind-body intervention rather than a purely physical exercise (32).

Episiotomy incidence halved (18.6% vs 34.3%; OR 0.44, 95% CI: 0.20-0.97, p=0.038), consistent with perineal body extensibility gains from butterfly/cat-cow sequences, mirroring 40% trauma reductions in Cochrane-reviewed perineal massage trials (33). This finding aligns with systematic evidence showing that prenatal exercises enhancing pelvic floor flexibility significantly reduce severe perineal trauma (RR 0.52, 95% CI: 0.29-0.94) and episiotomy rates (RR 0.71, 95% CI 0.52-0.98). The butterfly pose (baddha konasana) and cat-cow sequence (marjaryasana-bitilasana) specifically target perineal musculature and ligamentous structures, promoting tissue elasticity through sustained stretch and dynamic mobilization of the sacrotuberous ligaments and levator ani complex (34). Biomechanically, these movements counteract gestational collagen remodeling that predisposes to perineal rigidity, increasing extensibility by 15-25% as measured by perineal body ultrasound post-training (35). Unlike passive perineal massage (NNTB 21 for episiotomy avoidance), yoga integrates active maternal agency, fostering proprioceptive awareness and controlled pushing coordination during crowning, thereby minimizing iatrogenic incisions (36).

Neonatal Apgar comparability (p>0.20) affirms maternal benefit selectivity, with 1-minute scores (intervention 8.2±0.6 vs control 8.0±0.8) and 5-minute (9.1±0.4 vs 9.0±0.5) matching 15 prenatal yoga RCTs (n=2,156) demonstrating no fetal compromise despite maternal exertion. Theoretical underpinning lies in preserved uteroplacental perfusion: yoga-induced maternal HRV optimization (+35% LF/HF ratio) buffers catecholamine surges, maintaining fetal oxygenation (cord pH ↓0.02 units vs controls) and acid-base homeostasis per Doppler velocimetry studies. Unlike epidural analgesia (Apgar <7 OR 1.4), yoga avoids hemodynamic shifts, affirming selective maternal optimization without fetal penalty, a cornerstone for primigravida safety profiles (37–40).

This trial's methodological rigor concealed stratified block randomization, blinded partograph assessment, intention-to-treat with multiple imputation, and 88.8% protocol adherence, surpasses many included in prior meta-analyses (median Jadad score 2/5). The community-based design addresses critical external validity gaps, as 68% of prior RCTs originated from tertiary centers. Limitations include single-site generalizability (though socioeconomic diversity mitigates selection bias) and potential attention effects unaddressed by sham controls; however, identical antenatal visit frequency equalized nonspecific care (9).

Limitations include a single-center design that limits generalizability, unverified adherence to home practice, restriction to low-risk primigravida, and the absence of pain/satisfaction measures. Provider variation may also influence secondary outcomes. Future multicenter trials should evaluate dose-response relationships, multiparous populations, and long-term maternal/neonatal outcomes.

5. Conclusions

This randomized controlled trial demonstrates that structured prenatal yoga delivered twice weekly from 26-32 week gestation meaningfully shortens labor duration among low-risk primigravida women attending community-based care in Indonesia. The intervention improves key birth outcomes by enhancing spontaneous vaginal delivery rates while reducing analgesia requirements and episiotomy incidence, with effects persisting after statistical adjustment for relevant confounders. These findings establish prenatal yoga as an effective, feasible non-pharmacological strategy to optimize labor outcomes in resource-limited settings and support its systematic integration into routine midwifery practice and national maternal health guidelines.

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List of Abbreviations

ANCOVA	Analysis of Covariance
BMI	Body Mass Index
BPJS Kesehatan	Badan Penyelenggara Jaminan Sosial Kesehatan (Indonesian National Health Insurance)
CI	Confidence Interval
CONSORT	Consolidated Standards of Reporting Trials
EPDS	Edinburgh Postnatal Depression Scale
GDM	Gestational Diabetes Mellitus
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HARS	Hamilton Anxiety Rating Scale
ICIQ	International Consultation on Incontinence Questionnaire
IDR	Indonesian Rupiah
IQR	Interquartile Range
IUGR	Intrauterine Growth Restriction
ITT	Intention-to-Treat
MD	Mean Difference
OR	Odds Ratio
PIH	Pregnancy-Induced Hypertension
PP	Per-Protocol
RCT	Randomized Controlled Trial
SD	Standard Deviation
SMD	Standardized Mean Difference
SVD	Spontaneous Vaginal Delivery
WHO	World Health Organization

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