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A Comparative Study: The Influence of Prenatal Exercise Frequency on Normal Vaginal Delivery among Parturient Mothers at IBUNDA Maternity Clinic

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Abstract. Background: The rise in operative obstetric interventions during delivery is frequently triggered by prolonged labor or uterine dystocia caused by inadequate maternal physical endurance. Although structured prenatal exercise conditions the birth canal, empirical evidence regarding the dose-response relationship of cumulative sessions in primary care settings remains limited. Objective: To analyze the influence of cumulative prenatal exercise frequency on achieving normal vaginal delivery among delivering mothers at the Ibunda Maternity Clinic. Methodology: This analytical cross-sectional study involved 40 delivering mothers (N = 40) from May to June 2026, recruited via consecutive sampling. Inclusion criteria comprised single live fetuses under ideal baseline obstetric conditions (92.5% vertex presentation, normal birth weight) to minimize confounding factors. Since the exercise frequency data were non-normally distributed according to the Shapiro-Wilk test (p = 0.000), bivariate analysis utilized the non-parametric Mann-Whitney U test (alpha = 0.05) to compare the normal vaginal delivery group (n = 33) and the assisted/SC group (n = 7). Results and Discussion: Respondents attended prenatal exercise within a range of 2–24 sessions, with a mean of 11.70 \pm 6.82 sessions. The Mann-Whitney U test revealed a statistically significant difference in exercise frequency between the two delivery outcome groups (U = 20.000; Z = -3.439; p = 0.001). The normal delivery group exhibited a significantly higher Mean Rank (23.39) compared to the assisted/SC group (6.86). Physiologically and psychologically, a higher frequency of physical training enhances pelvic joint flexibility and suppresses stress hormones, thereby mitigating maternal exhaustion during the second stage of labor. Conclusion: There is a statistically significant difference in prenatal exercise frequency based on delivery outcomes. Regular and repetitive participation in prenatal exercise significantly improves the likelihood of achieving a normal spontaneous vaginal delivery.

Keywords: Cross-Sectional Studies; Delivery, Obstetric; Exercise; Maternal Health; Pregnancy.

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1. Background

The process of parturition represents a critical phase within the female reproductive cycle, involving complex interactions among biomechanical factors, hormonal fluctuations, and maternal physical readiness (Davenport et al., 2022; Butar Butar & Simanjuntak, 2024). Although spontaneous vaginal delivery remains the globally recommended ideal clinical outcome, the trajectory of operative obstetric interventions-ranging from vacuum extraction and forceps to Cesarean Section (CS)-continues to rise significantly across both primary and secondary healthcare facilities (Nascimento et al., 2022; Lutfiana et al., 2025). Clinically, this high rate of interventional delivery is frequently triggered by prolonged labor or uterine dystocia. These complications often stem from insufficient maternal cardiorespiratory capacity, poor physical endurance, and diminished elasticity of the pelvic floor muscles during gestation (Choi et al., 2024; Dipietro et al., 2021).

To mitigate these complications, the preservation of prenatal physical fitness through structured activities such as prenatal exercise is highly recommended (Rodriguez-Blanque et al., 2021). The primary components of prenatal exercise encompass pelvic floor muscle training, pelvic ligament stretching, and respiratory management exercises (Choi et al., 2024; Sari & Lestari, 2024). Physiologically, these 30-minute exercise sessions serve to condition the birth canal by enhancing pelvic joint flexibility, which facilitates the optimal descent of the fetal head toward the pelvic inlet (Aoyama et al., 2021; Indarti & Kustiyati, 2023). Beyond these biomechanical benefits, routine prenatal activity exerts a psychologically protective effect by suppressing the secretion of stress hormones (such as cortisol and catecholamines) that could otherwise inhibit uterine contractions during the active phase of labor (Sari & Lestari, 2024; Anggraeni & Hadiningsih, 2023).

Based on the preliminary framework, the variable identification in this study designates the cumulative frequency of prenatal exercise attendance (a quantitative independent variable) as the primary predictive factor for the delivery method outcome (a categorical dependent variable), which is classified into unassisted normal vaginal delivery and medically assisted/interventional delivery. The urgency of this research is underscored by a distinct empirical research gap within contemporary midwifery literature. The majority of prior studies have merely evaluated the efficacy of prenatal exercise using a simplistic dichotomous design (participation vs. non-participation), completely disregarding the dose-response relationship, namely the actual cumulative number of sessions attended by the mother (Hidayati et al., 2023; Pratiwi et al., 2023). However, maternal anatomical adaptation and functional capacity require consistent and repetitive physical stimulation (Nascimento et al., 2022). Furthermore, the scarcity of rank-based inferential evidence within local, private primary clinics restricts the accuracy of labor dystocia risk stratification (Wahyuni & Rahmawati, 2025; Debora et al., 2025).

The Ibunda Maternity Clinic is a midwifery healthcare facility that actively promotes prenatal classes. Nevertheless, the variation in maternal attendance compliance remains highly fluctuating, spanning from 2 to 24 sessions throughout the gestational period. Consequently, this study aims to rigorously analyze the influence and variation of cumulative prenatal exercise frequency on the achievement of normal vaginal delivery among parturient mothers at the Ibunda Maternity Clinic..

2. Research Methodology

Research Design

This study utilized an analytical research design with a cross-sectional approach. Through this framework, the evaluation of the independent variable (cumulative attendance frequency in 30-minute prenatal exercise sessions) and the dependent variable (delivery method at the time of admission) was conducted simultaneously by reviewing medical records and prenatal class control cards upon the completion of the delivery process at the Ibunda Maternity Clinic.

Population and Sample

The target population for this study comprised all parturient mothers who registered for antenatal care and completed their delivery at the Ibunda Maternity Clinic. From this population, a sample matching the eligibility criteria was gathered, totaling 40 respondents ($N = 40$). The inclusion criteria specified parturient mothers with term gestations (37–41 weeks), a single live fetus, and ideal general obstetric baselines—such as a predominant vertex presentation (92.5%) and a normal infant birth weight range (2.7–3.6 kg)—to minimize confounding bias arising from cephalopelvic disproportions (CPD). Parturient mothers with absolute complications that contraindicated physical activity were excluded from the study.

Sampling Technique

Sampling was executed using a consecutive sampling method conducted from May to June 2026. Through this non-probability technique, every parturient mother admitted to the Ibunda Maternity Clinic within the two-month window who met all inclusion criteria was sequentially enrolled as a research respondent until the minimum sample quota was satisfied, thereby preserving data representativeness without arbitrary selection bias.

Ethical Considerations

The entire sequence of procedures in this study was conducted in strict accordance with the national principles of medical and midwifery ethics. Prior to data collection, the researchers provided a comprehensive explanation regarding the study objectives and the right to decline participation, obtaining written informed consent from each respondent or their legal representative. The principle of anonymity was rigorously enforced by assigning numerical codes to observation sheets and removing personal identifiers. Confidentiality was fully guaranteed, ensuring that maternal clinical frequency data were utilized solely for scientific analysis. This observational study introduced no new clinical interventions outside the clinic's standard protocols, thereby adhering to the principle of non-maleficence.

Data Processing and Analysis

Data compiled via observation sheets and medical records were systematically processed through editing, coding, entry, and cleaning phases. Data analysis was executed in two successive stages:

a. Univariate Analysis: Used to describe the sociodemographic characteristics of the respondents (age, educational level, occupation, parity) via frequency distributions and percentages. Continuous numerical data (gestational age, maternal weight, infant birth weight, and prenatal exercise frequency) were presented as mean values, standard deviations (SD), and minimum-maximum (Min-Max) ranges.
b. Assumption Testing and Inferential Bivariate Analysis: Given the small sample size ($N < 50$), data normality for the prenatal exercise frequency variable was evaluated using the Shapiro-Wilk test. The Shapiro-Wilk test yielded a significance value of $p = 0.000$ ($p < 0.05$), indicating that the data were non-normally distributed. Due to this violation of the normality assumption, the parametric Independent T-Test was deemed inappropriate. Consequently, the inferential bivariate analysis shifted to the non-parametric Mann-Whitney U test at a 95% confidence level (alpha = 0.05). This test evaluated significant differences based on session accumulation ranks (Mean Rank and Sum of Ranks) between the normal spontaneous delivery group (Group 1, $n = 33$) and the assisted/SC delivery group (Group 2, $n = 7$).

3. Results and Discussion

Sociodemographic and Clinical Characteristics of Research Subjects

The evaluation of sociodemographic data included maternal age, educational level, parity, and occupational status. Meanwhile, clinical characteristics encompassed fetal presentation, delivery method, gestational age, maternal weight, infant birth weight, and the frequency of participation in prenatal exercise. A comprehensive summary of the frequency distributions and descriptive values for all variables is presented in Table 1.

Data Normality Testing

Prior to executing comparative hypothesis testing, a normality assumption test was performed for the primary variable, "Frequency of Prenatal Exercise Sessions." Because the sample size in this study was fewer than 50 respondents ($N = 40$), the inferential parameter was drawn from the Shapiro-Wilk method. The testing demonstrated a statistical significance value of $p = 0.000$ ($p < 0.05$). Based on these criteria, it was concluded that the data for the frequency of prenatal exercise sessions deviated significantly from a normal distribution. Therefore, the comparative analysis to assess differences between groups required a non-parametric test, specifically the Mann-Whitney U test.

Comparative Analysis of Prenatal Exercise Sessions Based on Delivery Methods (Mann-Whitney U Test)

A comparative test was conducted to analyze whether there was a significant difference in prenatal exercise participation frequency between mothers in Delivery Method Group 1.00 ($n = 33$) and Group 2.00 ($n = 7$). The calculated values for the mean ranks and inferential test parameters are detailed in Table 2.

Tabel 1. Distribusi Karakteristik Sosiodemografi dan Klinis Responden (N = 40).

Karakteristik Subjek	f (%)	Mean ± SD (Min–Max)
Variabel Kategoris		
Usia Ibu		
< 20 tahun	4 (10,0%)	—
20–35 tahun	32 (80,0%)	—
> 35 tahun	4 (10,0%)	—
Tingkat Pendidikan		
Pendidikan Dasar (SD)	2 (5,0%)	—
Pendidikan Menengah Pertama (SMP)	6 (15,0%)	—
Pendidikan Menengah Atas (SMA)	21 (52,5%)	—
Pendidikan Tinggi (PT)	11 (27,5%)	—
Paritas		
Primigravida	20 (50,0%)	—
Multigravida	20 (50,0%)	—
Pekerjaan		
Ibu Rumah Tangga (IRT)	25 (62,5%)	—
Karyawan Swasta	5 (12,5%)	—
Pegawai Negeri Sipil (PNS)	10 (25,0%)	—
Presentasi Janin		
Presentasi Kepala	37 (92,5%)	—
Presentasi Bokong	2 (5,0%)	—
Letak Lintang	1 (2,5%)	—
Metode Persalinan		
Kelompok 1.00	33 (82,5%)	—
Kelompok 2.00	7 (17,5%)	—
Variabel Kontinus		
Usia Kehamilan (minggu)	—	39,23 ± 1,03 (37–41)
Berat Badan Ibu (kg)	—	70,18 ± 5,91 (59–83)
Berat Lahir Bayi (kg)	—	3,14 ± 0,21 (2,7–3,6)
Frekuensi Senam Hamil (sesi)	—	11,70 ± 6,82 (2–24)

Catatan: f = frekuensi; % = persentase; SD = Standard Deviation; Min = Minimum; Max = Maximum. Gaya format merujuk pada standar APA 7th Edition (tanpa garis vertikal).

Based on the analysis results in Table 2, a statistically significant difference was detected in the frequency of prenatal exercise participation between the two delivery method groups (U = 20.000; Z = -3.439; p = 0.001). Mothers in Group 1.00 exhibited a substantially higher Mean Rank for prenatal exercise sessions (23.39) with a Sum of Ranks of 772.00 compared to mothers in Group 2.00, who only attained a Mean Rank of 6.86 and a Sum of Ranks of 48.00.

The observed significance value (p = 0.001) is much lower than the study's alpha threshold (alpha = 0.05), remaining highly significant even at the rigid level of alpha = 0.01. This empirical finding strongly implies that the number of sessions or frequency of involvement in prenatal exercise attended by the mother during the prenatal period is closely and directly related to the likelihood of the subsequent delivery outcome. Mothers who actively and regularly attended prenatal exercise sessions demonstrated a significantly more dominant accumulation rank within the normal delivery classification.

Tabel 2. Hasil Analisis Perbedaan Sesi Senam Hamil Berdasarkan Metode Persalinan Menggunakan Uji Mann-Whitney U.

Metode Persalinan	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	p-value
Kelompok persalinan normal	33	23,39	772,00			**0,001****
				20,000	**-3,439**	
Kelompok persalianan SC	7	6,86	48,00			**20,000 -3,439 0,001****

Catatan: ** Signifikan secara statistik pada tingkat p < 0,01 (2-tailed).

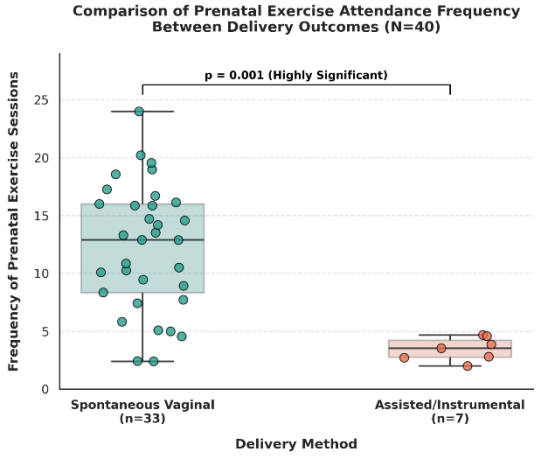

Figure 1. Comparison of Prenatal Exercise Attendance Frequency Based on Delivery Method**.**

This cross-sectional study successfully establishes a significant difference in the frequency of prenatal exercise participation between mothers who deliver via normal vaginal delivery and those who deliver through assisted methods. Mothers with high compliance and frequency of prenatal exercise were shown to reside predominantly within the normal delivery cohort. This finding solidifies global clinical evidence that structured physical activity during gestation plays a crucial role in conditioning the birth canal and preparing the mother psychologically for delivery (Davenport et al., 2022).Physiologically, regular movements in prenatal exercise, such as pelvic floor muscle training and breathing techniques, contribute directly to enhancing the elasticity of the perineal muscles and the flexibility of the pelvic joints (Choi et al., 2024). Consistent training stimulates the stretching of pelvic ligaments, thereby easing the descent of the fetal head toward the pelvic inlet (Aoyama et al., 2021). This is supported by the clinical characteristics of the respondents in this study, where 92.5% of the fetuses were in a vertex presentation—an ideal anatomical condition that optimizes the effectiveness of uterine contractions when combined with maternal physical fitness (Hidayati et al., 2023).In addition to biomechanical parameters, the psychological dimension of prenatal exercise cannot be ignored. Regular attendance in prenatal exercise classes has been reported to downregulate the secretion of stress hormones like cortisol and catecholamines, which can otherwise trigger uterine dystocia or prolonged labor due to heightened anxiety (Sari &

Lestari, 2024). Breathing management practiced repetitively induces relaxation and raises the mother's pain tolerance threshold during the active phase of the first stage of labor, thereby lowering the requirement for emergency medical interventions such as Cesarean Sections or vacuum extractions (Rodriguez-Blanque et al., 2021). Conversely, the low prenatal exercise participation in Group 2.00 (Mean Rank: 6.86) implies a lack of cardiorespirational capacity and maternal physical stamina, elevating the risk of maternal exhaustion during the second stage of labor (Dipietro et al., 2021).Nevertheless, several clinical confounders that also dictate the success of normal deliveries within this cohort must be acknowledged. The birth weights of the infants in this study fell within a highly ideal spectrum (3.14 \pm 0.21 kg), minimizing the baseline risk of cephalopelvic disproportion (CPD) (Wahyuni & Rahmawati, 2025). Given the constraints of the cross-sectional design, which did not control for parity—even though its distribution was evenly split between primigravidae and multigravidae (50.0%)—future research should adopt a prospective cohort approach (Nascimento et al., 2022). This is necessary to isolate the unconfounded effects of prenatal exercise duration and intensity on birth outcomes more definitively. Overall, the findings of this study reinforce that health promotion regarding prenatal classes must be intensified at primary care facilities like the Ibunda Maternity Clinic to increase safe, unassisted vaginal delivery rates.

4. Conclusion

Based on the comparative analysis using the non-parametric Mann-Whitney U test, this study concludes that there is a statistically significant difference in the frequency of prenatal exercise participation between mothers who deliver via normal vaginal delivery and those who deliver through medical intervention/SC (U = 20.000; Z = -3.439; p = 0.001). Mothers in the normal delivery group exhibited a vastly higher and more dominant cumulative rank of prenatal exercise sessions (Mean Rank = 23.39) compared to mothers in the intervention/SC group (Mean Rank = 6.86).These findings provide empirical evidence of a dose-response relationship, indicating that a higher and more consistent frequency of maternal participation in prenatal exercise during the antenatal period yields a greater probability of achieving a successful spontaneous delivery without intervention. Physiologically, repetitive exercise stimulates pelvic floor muscle elasticity and ligamentous stretching, which facilitates optimal fetal head descent. Psychologically, this routine suppresses stress hormones that can precipitate uterine dystocia. Nonetheless, this success was also supported by the homogeneous and ideal baseline clinical conditions of the respondents, including normal infant birth weights (3.14 \pm 0.21 kg) and a high prevalence of vertex presentation (92.5%), which naturally minimized the risk of cephalopelvic disproportion (CPD).).

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