

Original Article

Differences in birth ball use on the duration of the active phase of first-stage labor in primigravida mothers

Kafsah^{1,2}, Rifzul Maulina³

¹Coordinator Midwifery at Paminggir Public Health Center, Indonesia

²Undergraduate Midwifery Program, Institut Teknologi Sains and Health RS dr. Soepraoen, Indonesia

³Department of Midwifery, Institut Teknologi Sains dan Kesehatan RS dr. Soepraoen, Indonesia

Abstract:

Prolonged labor remains an important clinical problem because it increases maternal fatigue, anxiety, infection risk, postpartum hemorrhage, and fetal compromise. The active phase of the first stage of labor is a critical period for monitoring cervical dilatation and fetal descent, especially in primigravida mothers who often experience a longer labor process. Birth ball exercise is a simple non-pharmacological method that supports upright positioning, pelvic mobility, and maternal comfort during labor. This study analyzed the difference in the duration of the active phase of first stage labor between primigravida mothers who used a birth ball and those who did not use a birth ball at Paminggir Public Health Center. This study used a quasi-experimental static-group comparison design. The sample consisted of 40 primigravida mothers in active phase labor, divided into 20 mothers in the intervention group and 20 mothers in the control group. The intervention group performed birth ball exercise with pelvic rocking, while the control group received standard mobilization support without a birth ball. Labor progress was recorded using a partograph and maternal card. Data were analyzed using the Mann-Whitney U test. The mean duration of the active phase of first stage labor was 156.8 minutes in the intervention group and 259.6 minutes in the control group. The median duration was 132 minutes in the intervention group and 262.5 minutes in the control group. The Mann-Whitney U test showed a significant difference between the two groups with $p < 0.001$. Birth ball use significantly shortened the active phase of first stage labor among primigravida mothers. Birth ball exercise can be integrated into midwifery care as a safe, low-cost, and non-pharmacological intervention when applied with proper assessment and supervision.

Keywords:

birth ball, childbirth, first stage of labor, active phase, primigravida

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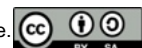
Corresponding Author:

Rifzul Maulina

rifzulmaulina@itsk-soepraoen.ac.id

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INTRODUCTION

Maternal mortality remains a core indicator of health system quality because most maternal deaths occur during pregnancy, childbirth, or the postpartum period, and many are preventable through timely, respectful, and evidence-based care. Global estimates show that progress in reducing maternal mortality has slowed in several regions, while the Sustainable Development Goals

require countries to reach fewer than 70 maternal deaths per 100,000 live births by 2030 (World Health Organization et al., 2023; Souza et al., 2024). Indonesia has made progress, but maternal and neonatal outcomes still need strong primary care, skilled birth attendance, timely referral, and safe intrapartum management (Badan Pusat Statistik, 2020). The 2017 Indonesia Demographic and Health Survey reported that prolonged labor was one of the most common birth complications reported by women in Indonesia, showing that labor progress remains a practical issue in maternal care (BKKBN et al., 2018). Prolonged labor can increase fatigue, infection, dehydration, obstructed labor, postpartum hemorrhage, fetal distress, and operative delivery. These risks make early, simple, and feasible interventions during normal labor important for community-level maternity services.

The first stage of labor begins with regular uterine contractions that cause cervical effacement and dilatation. It includes the latent phase and active phase. The active phase is clinically important because cervical dilatation accelerates, and fetal descent becomes more evident. In primigravida mothers, the active phase can last longer than in multigravida mothers because the cervix and pelvic floor structures have not undergone previous birth-related adaptation. Longer labor may increase pain, anxiety, and maternal exhaustion, which can reduce coping ability and affect the rhythm of contractions. Skilled monitoring through a partograph helps midwives identify delayed progress, fetal heart rate abnormalities, and maternal risk signs in a standardized manner (JNPK-KR, 2017). However, monitoring alone does not shorten labor. Midwives also need supportive measures that can improve maternal mobility, maintain comfort, and support fetal alignment without increasing clinical risk.

Non-pharmacological labor support has received renewed attention because it can strengthen maternal participation in childbirth and reduce unnecessary dependence on medical intervention. Continuous support, therapeutic communication, massage, breathing techniques, upright position, walking, prenatal yoga, pelvic rocking, and birth ball use are methods that can be integrated into normal labor care when mothers meet safety criteria (Bohren et al., 2017; Atunisa et al., 2024; Dahlan et al., 2023; Ismarina et al., 2023). These interventions are not substitutes for emergency obstetric care. They are supportive techniques for low-risk labor. Their value lies in reducing pain, anxiety, and immobility while preserving the physiological process of birth. Supportive communication is also essential because mothers need clear explanations, consent, encouragement, and reassurance before and during movement-based interventions (Kurniawan et al., 2024).

A birth ball is an inflatable exercise ball used during pregnancy and labor to help mothers sit upright, rock the pelvis, rotate the hips, lean forward, or assume positions that reduce back pressure. Its mechanism is biomechanical and neurophysiological. Sitting upright on the ball helps use gravity to support fetal descent. Pelvic rocking increases pelvic mobility and can assist fetal head positioning. Rhythmic movement may reduce muscle tension, increase maternal comfort, stimulate endorphin release, and improve confidence during contractions (Gau et al., 2011; Makvandi et al., 2015; Grenvik et al., 2022). Birth balls are also low-cost, easy to clean, reusable, and suitable for midwife-led care, provided that the mother has no obstetric contraindication and receives supervision.

Evidence from previous studies supports the use of birth balls and related pelvic movement techniques during labor. Systematic reviews reported that birth ball exercise can reduce labor pain and may shorten labor duration (Makvandi et al., 2015; Makvandi et al., 2019; Grenvik et al., 2022).

Evidence showing that birth ball use reduced pain intensity in the active phase of the first stage of labor and that pelvic rocking shortened the first stage of labor (Carolyn et al., 2023; Nuraeni et al., 2024). Other studies found that the use of a birthing ball improved first-stage labor progress among primigravida mothers (Mu'alimah & Wigati, 2022; Phalswal et al., 2024). These findings indicate that birth ball use has practical relevance for midwifery services, especially in facilities that support normal birth and non-pharmacological pain management.

Despite this evidence, not all community health centers and independent midwife practices incorporate the birth ball exercise into labor care. Barriers include a lack of training, limited equipment, safety concerns, unclear standard operating procedures, and uneven maternal knowledge. In several settings, mothers still spend much of the active phase in bed, although freedom of movement and upright positions can improve comfort and help labor progress (Lawrence et al., 2013; Shilling et al., 2007). Paminggir Public Health Center needs evidence that aligns with its service context so midwives can decide whether to integrate birth ball use into routine intrapartum care. This study, therefore, examined differences in the duration of the active phase of first-stage labor between primigravida mothers who used a birth ball and mothers who did not use a birth ball.

METHOD

This study used a quantitative quasi-experimental design with a static-group comparison approach. The design compared two groups of primigravida mothers in the active phase of labor. The intervention group used a birth ball, while the control group did not use a birth ball and received standard labor mobilization support. This design was selected because the study aimed to compare the duration of the active phase of the first stage of labor between two naturally available service groups in a real midwifery practice setting. The study was conducted at TPMB X in the working area of Paminggir Public Health Center from May to July 2022.

The population consisted of primigravida mothers who gave birth during the study period and met the clinical criteria for normal labor. The sample included 40 respondents, divided into 20 respondents in the intervention group and 20 respondents in the control group. The sampling technique used was incidental sampling because respondents were recruited when they presented in labor and met the eligibility criteria. Inclusion criteria were willingness to participate, term pregnancy, singleton fetus, vertex presentation, active phase of first stage labor, intact or clinically safe membranes according to the attending midwife's assessment, no history of pregnancy complications, and no diagnosis of hypertension, diabetes mellitus, hepatitis, fetal distress, or other conditions requiring immediate referral or operative management. Exclusion criteria were refusal to participate, high-risk pregnancy, emergency obstetric condition, abnormal fetal presentation, incomplete labor records, and complications that occurred before the intervention could be completed.

The independent variable was birth ball use during the active phase of first-stage labor. The dependent variable was the duration of the active phase of first-stage labor, measured in minutes from 4 cm cervical dilatation until complete dilatation. The intervention group received guided birth ball exercise. Mothers sat on the birth ball with both feet firmly on the floor, supported by a midwife or family member. They performed pelvic rocking, gentle forward and backward movement, side-to-

side movement, and circular hip movement for approximately 10 minutes during contractions or between contractions, as comfortable. The intervention was repeated while the mother remained clinically stable. The control group received standard care without a birth ball. Mothers were encouraged to stand, walk, change position, or perform gentle pelvic movement without the ball, based on comfort and midwifery assessment.

The main instruments were the maternal card and partograph. The maternal card recorded identity, obstetric history, pregnancy status, and relevant maternal characteristics. The partograph recorded cervical dilatation, contraction frequency and duration, fetal heart rate, membrane status, maternal pulse, blood pressure, temperature, and labor progress. The active phase was monitored in accordance with standard labor care principles. Cervical assessment and labor progress documentation were carried out by trained midwives. Fetal heart rate and maternal condition were monitored during labor to ensure safety.

Data were edited, coded, and entered into a statistical program. Univariate analysis described respondent characteristics, group distributions, and labor duration using frequencies, percentages, means, medians, and standard deviations. Bivariate analysis compared the duration of active phase labor between the intervention and control groups. Because the labor duration data were not normally distributed and the sample size was small, the Mann-Whitney U test was used. A p-value less than 0.05 was considered statistically significant. Ethical principles were applied through informed consent, voluntary participation, confidentiality of respondent identity, and the right to withdraw without affecting labor care. Birth ball use was stopped if the mother felt uncomfortable, unstable, or showed clinical signs requiring another management approach.

RESULT

The study involved 40 primigravida mothers, equally divided into an intervention and a control group. The intervention group consisted of mothers who used the birth ball during the active phase of the first stage of labor, while the control group consisted of mothers who did not use it. The characteristics of respondents are presented in Table 1.

Table 1. Characteristics of Primigravida Mothers Giving Birth at Paminggir Public Health Center

Characteristic	Category	Intervention Group		Control Group	
		Frequency	Percentage	Frequency	Percentage
Age	<20 years	8	40.0	3	15.0
	20-35 years	12	60.0	17	85.0
Education	Elementary school	1	5.0	1	5.0
	Junior high school	8	40.0	8	40.0
	Senior high school	9	45.0	10	50.0
	Bachelor	2	10.0	1	5.0
Occupation	Housewife	14	70.0	18	80.0
	Employee/self-employed	6	30.0	2	20.0

Table 1 shows that most respondents were aged 20 to 35 years. This age group accounted for 60.0% of respondents in the intervention group and 85.0% in the control group. Most respondents had a junior or senior high school education. Most respondents in both groups were housewives. Table 2 shows that the study groups were balanced, with 20 respondents in each group.

Table 2. Frequency Distribution by Study Group

Group	Frequency (n)	Percentage (%)
Intervention (birth ball)	20	50.0
Control (without birth ball)	20	50.0
Total	40	100.0

The difference in the duration of the active phase of first-stage labor between the two groups is presented in Table 3. The intervention group had a shorter mean and median labor duration than the control group. The mean duration was 156.8 minutes in the intervention group and 259.6 minutes in the control group. The Mann-Whitney U test produced $p < 0.001$, indicating a statistically significant difference between the two groups.

Table 3. Difference in Active Phase Duration of First Stage Labor

Group	Mean (minutes)	Median	SD	n	p-value
Intervention (birth ball)	156.8	132.0	59.3	20	<0.001
Control (without birth ball)	259.6	262.5	50.6	20	

DISCUSSION

This study showed that primigravida mothers who used a birth ball had a shorter active phase of first-stage labor than those who did not. The mean duration in the intervention group was 156.8 minutes, while the mean duration in the control group was 259.6 minutes. The median duration also showed a clear difference, with 132 minutes in the intervention group and 262.5 minutes in the control group. The p-value of <0.001 indicates that the difference is statistically significant. These findings support the use of birth ball exercise as a non-pharmacological method to help labor progress in low-risk primigravida mothers.

The effect of birth ball use can be explained through maternal position, pelvic mobility, and fetal descent. During the active phase of labor, cervical dilatation depends on effective uterine contractions, adequate fetal position, and the relationship between the fetal presenting part and the maternal pelvis. Sitting on a birth ball keeps the mother in an upright position. This position allows gravity to help the fetal head apply pressure to the cervix. Repeated pelvic rocking and circular hip movements can widen the pelvic outlet and reduce muscle tension in the lower back, pelvis, and perineum. These mechanisms may help the fetal head descend more efficiently and support cervical dilatation. Evidence on maternal mobility during the first stage of labor also supports the benefit of upright positions compared with prolonged supine positioning (Lawrence et al., 2013; Shilling et al., 2007).

This finding aligns with previous birth ball research. Gau et al. (2011) found that birth ball exercise reduced pain and improved childbirth self-efficacy. Makvandi et al. (2015) reported in a systematic review that birth ball use significantly reduced labor pain, while Makvandi et al. (2019) found evidence that birth ball exercises can influence delivery mode and labor duration. Randomized trials by Leung et al. (2013) and Taavoni et al. (2011, 2016) also support the role of birth balls in labor pain management. Grenvik et al. (2022) concluded that birthing balls reduce labor pain in randomized controlled trials. The current study adds facility-level evidence from Paminggir Public Health Center by focusing on the active phase duration among primigravida mothers, a group that often needs more support because they are having their first childbirth.

Carolin et al. (2023) reported that the birth ball method reduced labor pain intensity during the active phase of the first stage. Nuraeni et al. (2024) found that pelvic rocking exercise shortened the first stage of labor. Although pelvic rocking can be performed without a ball, the birth ball provides a more stable and comfortable medium for rhythmic movement. It allows mothers to sit, lean, and move their hips without excessive weight bearing. This feature may explain why mothers in the intervention group progressed faster than mothers in the control group, even though the control group also received advice to mobilize and change position.

Pain and anxiety may also mediate the relationship between birth ball use and shorter labor duration. Severe pain can increase sympathetic nervous system activity and stress responses. Anxiety and fear may increase muscle tension, reduce maternal cooperation, and disturb breathing patterns. Non-pharmacological measures such as endorphin massage, back massage, prenatal yoga, and birth ball movement can improve comfort and reduce anxiety during labor (Atunisa et al., 2024; Dahlan et al., 2023; Ismarina et al., 2023; Mrayan et al., 2024; Nori et al., 2023). A calmer mother can move, breathe, and follow midwifery guidance more effectively. This can support a more physiological labor process. The role of therapeutic communication is also important, as the mother needs clear instructions and reassurance when using the ball. Supportive communication can increase trust and reduce fear during care (Kurniyawan et al., 2024).

The role of the father or companion should not be ignored. Birth ball use is safer and more acceptable when the mother feels physically and emotionally supported. Başkurt and İldan Çalım (2023) showed that fathers who participated during childbirth gained positive experiences when midwives supported them and prepared them for their role. In this study context, a family member or companion could help stabilize the mother's posture, provide encouragement, and reduce fear while the mother performed movements on the ball. This kind of support is consistent with evidence that continuous support during childbirth improves maternal experience and clinical outcomes (Bohren et al., 2017).

The difference in active phase duration also has practical implications. A shorter active phase can reduce maternal fatigue, dehydration, and prolonged exposure to pain. It may also reduce the risk that a mother will be referred solely because of slow progress when no emergency indication exists. However, birth ball use must remain part of safe midwifery care. Midwives must assess maternal blood pressure, fetal heart rate, contraction pattern, cervical progress, fetal presentation, and maternal balance before allowing the mother to sit on the ball. The ball must match the mother's height, be non-slip, be placed on a stable surface, and be cleaned after use. Mothers should not be left alone on the ball, especially during strong contractions.

The results are also relevant for service planning at the community level. Birth balls are affordable and easy to implement. They do not require expensive equipment or medication. Health centers and independent midwife practices can include birth ball use in standard labor support protocols after staff training. Training should cover indications, contraindications, posture, exercise duration, infection prevention, documentation, and emergency stopping criteria. Pregnant women can also be introduced to the birth ball exercise during antenatal classes, so they are familiar with the method before labor. This is consistent with the broader role of pregnancy education in improving maternal knowledge and readiness (Adisti et al., 2024; Nuraeni et al., 2024).

This study has limitations. The design used a static-group comparison, so random allocation was not applied. Differences in maternal motivation, pain tolerance, family support, fetal head position, and midwife interaction may have influenced labor duration. The sample size was also limited to 40 respondents, limiting generalizability. The study measured labor duration but did not measure pain intensity, anxiety level, maternal satisfaction, delivery mode, or neonatal outcome. Future studies should use randomized controlled designs, larger samples, standardized intervention protocols, and additional outcomes. Despite these limitations, the study provides useful evidence that birth ball exercise can be used as a practical, safe method to support labor progress in eligible primigravida mothers.

CONCLUSION

The use of birth balls significantly shortened the active phase of first-stage labor among primigravida mothers at Paminggir Public Health Center. Mothers in the birth ball group had shorter mean and median labor durations than those in the control group. Birth ball exercise supports upright positioning, pelvic mobility, maternal comfort, and fetal descent. Midwives can use this method as a non-pharmacological intervention in low-risk labor after proper assessment, informed consent, and continuous supervision. Health centers and independent midwife practices should consider adding birth ball use to labor support protocols and antenatal education programs.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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