



The effectiveness of birth ball exercise on the progression of the first stage of labor

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ABSTRACT

Background: Prolonged labor is a significant contributor to maternal mortality rates. Various interventions have been attempted to reduce the incidence of prolonged labor, including the use of the birth ball method.

Objective: This study aimed to evaluate the impact of birth ball exercises on the progression of the first stage of labor.

Methods: We employed a quasi-experimental design with a posttest-only control group. The sample consisted of 30 mothers giving birth at Cibingbin Primary Health Care, with each group containing 15 respondents selected through purposive sampling. Data were analyzed using the Mann-Whitney U test.

Results: In the intervention group, all mothers experienced a normal progression of birth during the active phase of the first stage of labor, with an average labor duration of 5.70 hours. Conversely, in the control group, the majority (53.3%) experienced an abnormal progression of birth, with an average labor duration of 9.67 hours. The results indicated a significant difference in mean labor duration of 3.97 hours, demonstrating the birth ball's effect on the progression of birth (p -value < 0.001).

Conclusion: Birth ball exercises are a promising intervention for improving the progression of birth during childbirth. Therefore, these exercises can be implemented during normal labor. It is advisable that these exercises are supervised and guided by trained midwives or nurses.

Keywords: childbirth; first stage labor; birth ball

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INTRODUCTION

One of the Sustainable Development Goals (SDGs) aims to ensure a healthy life and well-being for people of all ages, with a specific focus on reducing maternal mortality rates that can occur during childbirth. Childbirth is a natural physiological process experienced by all women, but it can become a medical concern if a mother lacks an understanding of the physiological aspects of childbirth or if healthcare providers are not well-versed in managing both physiological and pathological aspects of the process. Reducing maternal mortality rates aligns with the objectives of the SDGs. Healthcare professionals, particularly midwives, play a crucial role in ensuring safe and normal childbirth. They need to closely monitor the progress

Nursing and Healthcare Practices

- Labor is a clinical diagnosis characterized by a change in the myometrial contractility pattern, transitioning from irregular contractions (prolonged low-frequency activity) to regular contractions (high-intensity and high-frequency activity).
- The use of a birthing ball technique is one method to assist mothers in managing pain and potentially expediting the progress of labor by facilitating cervical dilation.
- This intervention can be administered as part of maternal care during the first stage of labor and the delivery process, with midwives, doctors, or maternity nurses overseeing its implementation.

of labor to facilitate a smooth delivery (Rohani, Reni Saswita, 2019). The process of labor consists of several stages, including the first, second, third, and fourth stages. The first stage, in turn, is further divided into latent and active phases. The dilatation phase of labor is a critical component of the first stage (Albers, 2007). This phase commences when regular and progressively stronger contractions, in terms of frequency and intensity, lead to the full dilatation of the cervix, which measures 10 cm. For first-time mothers (primiparas), this stage typically lasts around 12 hours, while for those who have given birth before (multiparas), it lasts approximately 8 hours. The recommended cervical dilatation rate is approximately 1 cm per hour for primiparas and more than 1 cm to 2 cm per hour for multiparas (Prawirohardjo, 2015).

One of the causes of prolonged labor is abnormal progress during childbirth. Prolonged labor, also known as "prolonged partus," is characterized by a slow progression of labor due to factors such as disproportion between the fetal presentation part and the birth canal, a short cervix, or fetal abnormalities. Prolonged labor typically lasts for more than 24 hours. Abnormal progress during labor can lead to fatigue and stress, potentially resulting

in reduced maternal blood flow through the placenta and decreased oxygen supply to the fetus. This, in turn, can lead to fetal distress due to asphyxia. Factors related to the progress of the first stage of labor include maternal age, parity, uterine fundus height, gestational age, distance from pregnancy, activities during pregnancy, and physiotherapy. Prolonging the duration of labor can contribute to complications and labor-related issues. Extended labor phases may slow the descent of the baby's head, increasing the risk of fetal distress and, in severe cases, fetal mortality rates of up to 20% to 30% (Astuti & Nurhasanah, 2017).

The second stage of labor is known as the expulsion stage. During this stage, as the baby's head stretches the vaginal tissue, mothers experience sensations that signify the baby's imminent arrival. This stage begins when the cervix is fully dilated, and the baby is ready to be born due to contractions of the uterine muscles, creating an overwhelming urge that cannot be suppressed. One of the physiological changes that occur in the second stage is the descent of the baby's head to the base of the pelvis, causing the perineum to protrude, and the vulva to open (Yanti, 2010).

The application of best practices for normal delivery care, when executed optimally, has been shown to enhance the health status and quality of life of mothers in Indonesia. One effective measure in preventing prolonged labor is the use of the birth ball technique, which supports the physiological process of childbirth (Maryunani, A. Eka, 2017). A birth ball, which is a physiotherapy ball, has been proven to assist mothers during the first stage of labor. It can also be adjusted to the mother's height. Birth ball exercises can enhance the release of endorphins, providing a sense of comfort and promoting the progress of labor (Kurniawati, 2017).

According to the Indonesian Ministry of Health (2020), the most common cause of maternal death in 2019 was bleeding, with prolonged labor accounting for 4.3% of these cases (Kemenkes, 2021). The West Java Provincial Health Office (2020) reported that maternal deaths were most commonly caused by bleeding (28%) and hypertension (29%), though other causes remained high at 24%, including prolonged labor (Barat, 2021). Data from the Kuningan District Health Office revealed that the leading causes of death in Kuningan Regency were hypertension (29.1%), bleeding (16.7%), blood disorders

(12.5%), infection (8.3%), and other causes, with prolonged labor accounting for 33.4% (Kuningan, 2021). In 2020, the Cibingbin Health Center recorded 39 referral cases, including 12 cases of severe pre-eclampsia and 7 cases of bleeding (Kuningan, 2021).

Research conducted by Ulfa, RM (2021) demonstrated that the use of a birth ball can accelerate the duration of the first stage of labor and reduce labor pain during labor. Birth balls have been proven to be harmless and safe, making them a valuable alternative in midwifery services. Birthing ball exercises serve as an effective complementary method for reducing labor duration and alleviating labor pain. The fundamental movements on the birthing ball promote relaxation of the pelvic and perineal muscles in laboring mothers. Birth ball exercises can enhance blood circulation and oxygen supply influenced by uterine contractions, thereby expediting the labor process. Practicing with a birth ball provides numerous benefits, including increased maternal energy, improved posture, optimal fetal positioning, and facilitation of vaginal childbirth, ultimately reducing the need for surgical births (Ulfa, 2021).

Despite the various benefits associated with birth ball exercises, many women in healthcare facilities do not frequently use this method during pre-labor. This study aims to investigate the impact of birth ball exercise on the progression of labor during the first stage of childbirth. The hypothesis in this study posits that birth ball exercise has an effect on the progress of labor in the first stage.

METHODS

Design

This research employed a quantitative research approach with a quasi-experimental design to examine the relationship between dependent and independent variables. The research design utilized in this study was a posttest-only design with control groups.

Sample and Setting

This study was conducted at Cibingbin Primary Health Care, located in Cibingbin District, Kuningan Regency, West Java, Indonesia. The sampling technique employed in this research was non-probability sampling, which is based on practicality rather than calculated probability. Specifically, the non-probability sampling

technique used in this study was purposive sampling. Purposive sampling involves the researcher selecting subjects in advance based on specific research criteria established by the researchers within a predefined time frame until the required number of samples is met. The inclusion criteria for the samples in this study were as follows: mothers in labor in the first stage of labor, no history of complications during the prenatal period or comorbidities during pregnancy or labor, and a willingness to participate as respondents by signing an informed consent form.

The researchers divided the samples into two groups: the intervention group and the control group. The intervention group consisted of 15 mothers who were provided with birth ball exercises, while the control group comprised 15 mothers who met the criteria but did not receive birth ball exercises at the Cibingbin Primary Health Center. Several factors influence labor, including maternal power, the birth canal, the fetus, labor position, and maternal psychology. The progression of labor typically lasts around 12 hours for primiparas and approximately 8 hours for multiparas. A cervical dilatation rate of 1 cm per hour is expected for primiparas, while multiparas may dilate at a rate of more than 1 cm to 2 cm per hour (Nurasiah, 2014). The benefits of providing birth ball exercises include enhancing maternal comfort, shortening the duration of labor, muscle relaxation resulting in the release of endorphins, faster cervical dilatation, wider pelvic area (Aprilia, 2017), and promoting relaxation, which encourages the baby to descend and expedite the delivery process (Mutoharoh et al., 2020).

Variable

The slow progress of abnormal labor can significantly prolong the childbirth process. To address this issue, one effective approach is to incorporate the use of a birth ball, which promotes a more physiological labor process. In this study, the independent variable utilized was birth ball exercise. This involved providing laboring women in the first stage of labor with physical therapy balls that support various labor positions. These exercises were conducted for 30 minutes every hour during the first stage of labor, starting when the cervix had dilated to 4 cm and when contractions began, following the birth ball management procedure. The dependent variable in this study was the progress of birth during the first stage of labor. Progress in the first stage was defined

as the duration of the labor process ranging from 1 cm to 10 cm cervical dilation, without any labor-related obstacles or complications.

Instruments

The data collection tools and materials utilized in this study included partographs, the Birth Ball Exercise Standard Operating Procedure (SOP), and observation sheets to monitor the frequency of birth ball exercises conducted in accordance with standard operating procedures and to observe the progress of labor during the first stage.

Instrument 1: Partographs were employed to monitor the first stage of labor and provide critical information for making clinical decisions during childbirth, in line with WHO recommendations (Yulianti et al., 2019). Key points within the partograph encompassed labor progression, fetal condition, maternal condition, and the administration of drugs, IV fluids, and oxytocin (Dalal & Purandare, 2018).

Instrument 2: The Birth Ball Exercise Standard Operating Procedure (SOP) outlined five specific movements: sitting on the ball while leaning forward, standing and leaning over the ball, kneeling and leaning on the ball, squatting against the ball, and positioning the ball against a wall or backboard. These movements were designed to assist mothers during the first stage of labor by promoting optimal positions for labor progression and reducing discomfort in the lumbar, inguinal, birth canal, and surrounding areas. For more detailed descriptions of the birth ball exercises, Figure 2 can be referred to. The procedures used in this study were guided by the book titled "Complementary Midwifery Care" authored by Sari et al. (2022).

Instrument 3: Observation Sheets included fields for the patient's name, the duration of the first stage in hours (to assess normal or abnormal labor progress), and the provision of birth ball exercises (in both the control and intervention groups).

Data Collection

The researchers gathered data from mothers giving birth at Cibingbin Health Center during a one-month research period in May 2022. Data collection primarily relied on primary data, which refers to firsthand data acquired directly from research subjects using measurement tools or data collection instruments. Prior to data collection, the researchers sought permission

from the prospective respondents to participate in the study. The study's participants were divided into two groups: the intervention group (receiving birth ball exercises) and the control group (not receiving birth ball exercises). Informed consent was obtained from the mothers who were selected to participate in the study. Subsequently, the researchers monitored the progress of labor in both the intervention and control groups.

Before administering the birth ball exercises, each prospective respondent received information about the health requirements. These requirements included being a parturient mother experiencing pain, having a prolonged labor opening, and the baby's head taking a long time to descend. Prospective respondents were also informed about contraindications for using birth ball exercises, which encompassed conditions such as malpresentation of the fetus, antepartum bleeding, hypertension, loss of consciousness, risk factors for preterm labor, premature rupture of membranes, incompetent cervix, and fetal growth restriction (Kurniawati, 2017).

The intervention group comprised mothers who received birth ball exercises in various positions, following The Birth Ball Exercise Standard Operating Procedure (SOP). These exercises were conducted once every hour for 30 minutes during the first stage when the cervix had dilated to 4 cm and contractions had commenced. The control group consisted of mothers who did not receive birth ball exercises and served as a comparison group to assess differences that might emerge between the intervention and control groups during the course of childbirth.

Both the control and intervention groups were monitored using an observation sheet. This observation sheet contained data to assess the progress of labor during the first stage by examining the duration of labor from 1 cm to 10 cm cervical dilation without encountering any labor-related obstacles or complications. The expected outcome measures derived from the labor progress observation sheet included normal progress (if the first stage of labor in primiparous mothers lasted for 12 hours and in multiparous mothers about 8 hours) and abnormal progress (if the first stage of labor in primiparous mothers exceeded 12 hours and in multiparous mothers exceeded 8 hours) (Nurasiah, 2014).

Table 1. Frequency distribution of respondent characteristics (n=30).

Category	n	%
Age		
<20 years old	4	13.3
20-35 years old	26	86.6
Parity		
Primipara	19	63.3
Multipara	11	36.6
Gestational age		
32-35 week	1	3.3
36-40 week	29	96.6
Duration of first stage		
Normal	22	73.3
Not Normal	8	26.6

Table 2. Frequency distribution of progress of birth in the first stage of labor and birth ball exercise (n=30).

Progress of birth	Intervention group	Control group
	n (%)	n (%)
Normal	15 (100)	7 (46.7)
Not Normal	0 (0)	8 (53.3)
Total	15 (100)	15 (100)

Table 3. The effect of birth ball exercise on progress of birth in the first stage of labor (n=30).

Groups	Mean	Standard deviation	Mean difference	p
Intervention Group	5.70	0.97	3.97	< 0.001
Control Group	9.67	2.61		

Data Analysis

The hypothesis test employed in this study is the Mann-Whitney U Test. The data source consists of two distinct groups: one group receiving the intervention of birth ball exercises and the other group not receiving birth ball exercises. This study adopts a significance level of 5%. If the p-value is less than 0.05, the hypothesis is accepted, while if the p-value is greater than 0.05, the hypothesis is rejected.

Ethical Consideration

This research was conducted with strict adherence to the principles of research ethics. The principles of beneficence and nonmaleficence were followed, ensuring that the research procedures, purpose, and potential benefits were explained to the

research subjects. Additionally, the rights of research subjects were respected, informed consent was obtained, and the researchers ensured the confidentiality of the subjects' identities by using coding. The principle of justice was upheld, treating all subjects equally without differentiation. Furthermore, this study was conducted in full compliance with research ethics and received approval from the Ethics Board of the Institute of Health Science Kuningan, as evidenced by Research Ethics Letter No. 68/EP/STIKKU/2022.

RESULTS

In this study, the respondents' characteristics are as follows: 86.76% of them are aged between 20 and 35 years old, 63.3% are primipara in terms of parity, 96.6% have a

gestational age between 36 and 40 weeks, and 73.3% have a normal duration of the first stage of labor (Table 1).

The frequency distributions of progress in the first stage of labor and birth ball exercise are as follows: 100% of the respondents in the intervention group, who received birth ball exercises, exhibited a normal progress of labor, whereas 53.3% of the respondents in the control group, who did not receive birth ball exercises, experienced abnormal progress of labor (Table 2).

Table 3 displays the results of the study. In the intervention group (those who received birth ball exercise), birth mothers had an average progress of labor lasting 5.70 hours. On the other hand, in the control group (those who did not receive birth ball exercise), birth mothers had an average progress of labor lasting 9.67 hours. Consequently, the difference in mean values between the two groups was 3.97 hours. The results of the independent t-test, with a significance value threshold set at $p < 0.05$, led to the rejection of the null hypothesis. Thus, it can be concluded that birth ball exercise has a significant effect on the first stage of labor.

DISCUSSION

Frequency distribution of progress of birth in the first stage of labor

The birth ball is considered one of the complementary therapies that can be utilized during the late trimester of pregnancy to facilitate the labor process, particularly in the first stage of labor. Additionally, birth ball exercises have been found to effectively reduce pain during labor, specifically in areas such as the lower back, inguinal region, genitalia, and the surrounding areas. The use of birth ball exercises can also enhance the effectiveness of uterine contractions. Various positions, including sitting on the ball leaning forward, standing and leaning over the ball, kneeling and leaning on the ball, squatting while leaning on the ball, and sitting on the floor in a squatting position while leaning on or against the ball, can be adopted by mothers during labor to aid in their comfort and the progression of labor (Batubara & Ifwana, 2021).

The practice of deep-breathing techniques further contributes to the progress of labor and the comfort of laboring mothers. This technique stimulates the release of endorphins and activates receptors in the pelvis, enhancing

the overall labor experience. The influence of gravity is also significant when using the birth ball during labor. The ball's elasticity and curvature stimulate the progress of labor and facilitate the opening of the pelvis (James & Hudek, 2017). As the rate of cesarean section births is on the rise, birth ball exercises offer an alternative that encourages vaginal delivery, potentially reducing the need for cesarean births. The support and guidance provided by midwives in implementing birth ball exercises are crucial for mothers undergoing physiological labor (Taavoni et al., 2016).

Furthermore, birth ball exercises have been shown to increase blood flow to the uterus, placenta, and baby while minimizing tension. These exercises also provide comfort to the knees and ankles, exert back pressure in the perineum area and thighs, and, through the force of gravity, encourage the baby's descent, ultimately expediting the labor process (Mutoharoh & Indrayani, 2019). The specific movements performed while using the birth ball, such as pelvic shaking to the right, left, and in circular motions, exert pressure on the baby's head against the cervix, promoting faster cervical dilation and shortening the duration of the first stage of labor (Batubara & Ifwana, 2021).

Before the implementation of the birth ball technique, a notable occurrence was the descent of the lower segment of the fetus in the second stage, which was observed in almost all maternity respondents. Specifically, 11 people (69%) experienced this phenomenon. After the application of the birthing ball technique, which involved sessions lasting 15-30 minutes and subsequent re-examinations every 4 hours to evaluate labor progress, a significant change was noted. Most respondents exhibited a descent of the fetal head, with 10 people (63%) experiencing descent to the Hodge III level, and 6 people (37%) reaching the Hodge IV level. This indicates the effectiveness of the birthing ball in expediting the active phase of the first stage and achieving complete cervical opening in primiparous laboring mothers (Dewi, 2023). Notably, the group receiving guidance on using the gym ball progressed at a faster rate compared to those who did not receive such guidance (Sutisna, 2021).

The birth ball plays a crucial role in facilitating the descent of the fetus during labor. Mothers can position themselves on the ball and engage in movements such as swinging or hip-twisting while pushing. The birth ball provides support

to the perineum through applied pressure and helps maintain optimal fetal alignment within the pelvis. The birth ball exercise, particularly when adopting a sitting posture similar to the squatting position, aims to open the pelvis during labor. The light and deliberate movements made in this exercise position significantly alleviate the pain associated with uterine contractions. Moreover, mothers who engage in birth ball exercises tend to be more relaxed, leading to improved oxygen flow and uterine contraction activity, which, in turn, shortens the labor process. The enthusiasm and positive mindset of laboring mothers also contribute to their psychological well-being during labor. When laboring mothers have favorable conditions and follow midwives' recommendations regarding birth ball exercises, they are better equipped to cope with pain and foster a positive labor experience. The use of a birth ball during the active phase of the first stage helps laboring mothers adapt to pain and discomfort more effectively (Dewi, 2023).

The effect of birth ball exercise on progress of birth in the first stage of labor

The data collection tools and materials utilized in this study included partographs and observation sheets. These tools were employed to monitor the frequency of birth ball exercises conducted in accordance with standard operating procedures and to assess the progress of labor during the first stage of labor. The analysis of the data revealed a significant difference in the mean (average) duration of labor during the intervention group (those given birth ball exercise), with an average of 5.70 hours, compared to the control group (those not given birth ball exercise), with an average of 9.67 hours. The difference in the mean value was calculated to be 3.97 hours. The independent T-test results indicated a significance value of 0.000, which is less than the threshold of 0.05. This suggests that giving birth ball exercise influences the progress of birth during the first stage of labor.

An upright posture can stimulate cervical dilatation and expedite the labor process by widening the pelvic area, encouraging the descent of the newborn's head toward the pelvic floor (Aprilia, 2017). Complementary therapy involving birth ball exercises can significantly enhance the energy levels required

by mothers during labor. This approach places mothers in an upright position, facilitating faster labor progress and optimizing the fetal position for a smoother normal childbirth experience (Marshelia, 2022). Additionally, laboring mothers experience increased relaxation, improved oxygen flow, and tension reduction, ultimately alleviating labor pain (Aprilia, 2019).

The implementation of birth ball exercises has a significant impact on the duration of labor during the first stage, with a significance level of 0.000. The practice of birth ball exercises eases the first stage of labor, resulting in a normal duration of labor (Batubara & Ifwana, 2021). Based on supporting references regarding the reduction in the length of labor through birth ball exercises, it was found that the length of labor in primigravida women was reduced to 3 hours and 39 minutes. Birth balls or gym balls, as well as peanut balls, have been highly effective in decreasing the length of labor during the first stage, particularly in the primigravida group (Aprilia, 2019).

Hypothesis testing in other studies has also demonstrated that the group using birth balls experienced shorter labor times. In the intervention group, the first stage of labor lasted approximately 130.38 ± 39.28 minutes, while the control group had a longer duration of 257.85 ± 65.16 minutes. Similarly, the second stage of labor was shorter in the intervention group (30.08 ± 11.38 minutes) compared to the control group (36.85 ± 12.41 minutes). These findings align with the results of the present study, which indicate that the use of birth balls can reduce pain in laboring mothers and shorten the duration of both the active first stage and the second stage of labor (Ulfa, 2021).

The impact of birth ball exercises on the progress of labor can be attributed to the circular movements made by the pelvis when using the ball. These movements facilitate the descent of the fetus, leading to faster cervical dilatation, aided by the wider pelvic area. The movements also contribute to pain reduction during contractions. Sitting on the ball with pelvic rotations is a preferred position because it allows the mother to remain relaxed and less fatigued. By sitting on the ball, the mother can still benefit from gravity's assistance in moving the baby's head downward without the added strain of carrying the weight of her abdomen. These movements enhance the mother's comfort and support the progress of labor. The release of endorphin hormones is stimulated by the receptors in the pelvis, responding to

the anatomical shape and elasticity of the birth ball. Therefore, birth ball exercises effectively assist in managing pain and reducing its duration. In conclusion, the implementation of birth ball exercises has been successful, and the statistical test results indicate a significant positive effect of birth ball exercises on the progress of labor during the first stage (Ulfa, 2021).

Implication and limitation

Birth ball exercises can indeed aid in the process of fetal descent during labor. When a laboring mother sits on the ball and pushes while performing swings or pelvic twists, it can assist in the descent of the fetus. Using the birth ball provides support to the perineum without putting excessive pressure on it, and it helps align the fetus's position within the pelvis. When laboring mothers sit on the ball and follow instructions properly, their position is similar to that of squatting, which can be highly beneficial for widening the pelvis and expediting the delivery process.

The gentle movements executed by the mother during birth ball exercises can alleviate the pain of contractions. Additionally, mothers who engage in birth ball exercises tend to be more relaxed, ensuring smoother oxygen flow and more effective uterine contractions, ultimately resulting in shorter labor. The enthusiasm and positive attitude of laboring mothers can also significantly contribute to their psychological well-being, enabling them to face labor contractions with less anxiety and pain.

However, it's essential to note that birth ball exercises may not be suitable for all laboring women. This technique may not be recommended for those with multiple pregnancies, fetal malpresentation, complicated pregnancies, or those who are scheduled for a cesarean birth. The application of birth ball exercises should be considered on a case-by-case basis, taking into account the specific circumstances and needs of each laboring mother.

CONCLUSION

The progress of birth in the first stage of labor among the intervention group, who were provided with birth ball exercise, was entirely normal. In contrast, the progress of labor in the control group, who did not receive birth ball exercises, was partially abnormal. This

study demonstrates that there is a significant positive effect of giving birth ball exercise on the progress of birth during the first stage of labor. As a result, birth care that includes the provision of birth balls can be effectively applied by laboring mothers. This approach enables mothers to experience safer, more comfortable, and quicker childbirth compared to traditional care methods that do not include birth ball exercises.

Declaration of Interest

No actual or potential conflict of interest to this article.

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Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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