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Pelvic Rocking and Birth Ball Interventions to Reduce Duration of Second Stage of Labor and Improve Neonatal APGAR Scores

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ABSTRACT

Prolonged second-stage labor is a critical obstetric issue that increases the risk of maternal and neonatal complications, including postpartum hemorrhage and neonatal asphyxia. These complications can lead to low APGAR (Appearance, Pulse, Grimace, Activity, Respiration) scores, sepsis, and perinatal mortality. In Indonesia, 12–15% of labor cases are reported to be prolonged, highlighting the need for effective interventions. This study aimed to analyze the effects of pelvic rocking exercises and birth ball use on the duration of the second stage of labor and neonatal APGAR scores.

This quasi-experimental study employed a post-test-only control group design and involved 40 primigravida mothers selected through purposive sampling from several health facilities in Gowa Regency, including TPMB Hj. Kasmawati, Hj. Hamsinah, Hj. Kumala Ratna, Bajeng Health Center, and Bontonompo II Health Center. Participants were divided into intervention and control groups. The intervention group received pelvic rocking exercises and birth ball therapy during labor.

The results showed a significant reduction in the duration of the second stage of labor in the intervention group compared to the control group (Mann–Whitney test, $p = 0.000$). However, there was no significant difference in neonatal APGAR scores at 5 minutes ($p = 0.673$) and 10 minutes ($p = 0.277$) between the groups. While pelvic rocking and birth ball interventions effectively shortened the second stage of labor through biomechanical and neuroendocrine mechanisms, they did not significantly influence neonatal outcomes as measured by APGAR scores, possibly due to other overriding clinical factors.

Keywords: *Pelvic Rocking, Birth Ball, Second Stage of Labor, APGAR Score, Maternal Outcome, Neonatal Outcome*

1. INTRODUCTION

Childbirth is a physiological process and a profoundly meaningful event for mothers and families alike (1–3). One of the most critical phases of labor is the second stage, which begins with full cervical dilation and ends with the delivery of the baby. If this stage is prolonged, it increases the risk of maternal and neonatal complications, such as fetal hypoxia, birth trauma, and the need for medical interventions including forceps or vacuum extraction. Prolonged second-stage labor contributes to the overall incidence of prolonged labor, which comprises four stages (I to IV). The second stage typically lasts about two hours in primiparous women and one hour in multiparous women (4–8).

According to the 2022 Indonesian Health Profile, approximately 12–15% of births in Indonesia involve prolonged labor, which elevates the risk of postpartum hemorrhage and neonatal asphyxia, both of which can affect APGAR (Appearance, Pulse, Grimace, Activity, Respiration) scores (9). Prolonged labor in neonates is associated with a higher risk of birth asphyxia, which leads to low APGAR scores within the first five minutes of life, as well as increased chances of sepsis and perinatal mortality (6,7,10,11). For mothers, it raises the likelihood of morbidity and the need for medical procedures such as cesarean section (12,13). The most recent Indonesian Demographic and Health Survey (SDKI) also reports that prolonged labor increases maternal and fetal trauma risks and worsens fetal perfusion, which can result in hypoxia and subsequently low APGAR scores (Khoiriah & Pratiwi, 2019). As the number of prolonged labor cases rises, the incidence of neonatal asphyxia also increases. Neonatal asphyxia is characterized by the newborn's inability to breathe spontaneously immediately after birth, leading to hypoxia and organ dysfunction, contributing significantly to neonatal morbidity and mortality (14–17).

Various methods have been developed to shorten the second stage of labor and improve neonatal outcomes, including APGAR scores. Among non-pharmacological techniques, **pelvic rocking** and the use of a **birth ball** have shown potential in obstetric care. Pelvic rocking involves mobilization exercises that maintain ligament flexibility and provide more room for fetal descent into the pelvis, thus helping to shorten labor duration (18–20). The birth ball utilizes gravity and pelvic motion to facilitate fetal descent while stimulating endorphin release, allowing labor to proceed more smoothly and comfortably (21–24).

The key difference between prenatal exercise during pregnancy and pelvic rocking and birth ball techniques during labor lies in their focus and intensity. Prenatal exercises aim to prepare the body by enhancing muscle flexibility, strength, and respiratory function, promoting good posture and reducing discomfort such as back pain (18,19,25,26). In contrast, pelvic rocking and birth ball exercises during labor are specifically intended to expedite fetal descent and shorten the duration of the second stage (27–31).

Studies have shown that pelvic rocking can reduce the second stage duration in primiparous mothers to an average of 29 minutes compared to 48 minutes in the control group. Similarly, birth ball usage shortens this stage to about 31 minutes compared to 43.3 minutes in the control group (Wahyuni et al., 2021). These reductions contribute to improved APGAR scores, decreased risks of complications such as asphyxia and trauma, and faster maternal recovery (8,32). In line with the 2023 Antenatal Care (ANC) guidelines, non-pharmacological methods such as pelvic rocking and birth ball exercises have been integrated into maternal and child health service programs aimed at accelerating labor and improving maternal and neonatal well-being (33,34).

Research by Surtiningsih et al. (2020) supports these findings, indicating that these methods not only expedite delivery but also improve neonatal APGAR scores, potentially reducing neonatal morbidity and mortality. During the active phase of labor, Indonesia's Directorate General of Public Health and local health departments emphasize the importance of pain management and recommend non-pharmacological interventions such as pelvic rocking and birth ball exercises. Support from healthcare providers and family members also plays a crucial role in ensuring a safe and positive labor experience. As a result, these techniques have become integral to labor management strategies across maternal healthcare services.

Despite the abundance of research supporting the individual effectiveness of pelvic rocking and birth ball methods in enhancing labor outcomes, studies specifically examining their combined effect on the second stage of labor and neonatal APGAR scores remain limited. Therefore, further research is necessary to evaluate their effectiveness in broader clinical contexts. Based on this background, the present study aims to analyze the impact of pelvic rocking and birth ball interventions on the duration of the second stage of labor and neonatal APGAR scores.

2. METHOD

The type of research used is a quasi-experiment with a post-test only control group design . This study was conducted from November to December 2024 in five places, namely three Independent Midwife Practice Places (TPMB Hj. Kasmawati, TPMB Hj. Hamsinah, and TPMB Hj. Kumala Ratna) and two Health Centers (Bajeng and Bontonompo II) in Gowa Regency. The population in this study were all primigravida mothers who gave birth at the research location during that period. The number of samples in this study was determined using the *Lem show formula:*

$$\underline{n = (Z\,a\,\sqrt{2PQ} + Z\beta\,\sqrt{P1Q1 + P2Q2})^2}$$

$$(P1 - P2)^2$$

Information:

n : sample size

Zα : type I error (α) of 5% = 1.96

Zβ : type II error of 80% = 0.842

Q : 1

P1 : -5.5

OR : 1.7

Q : 0

Q1 : 6.5

Q2 : 6.5

$$\underline{n = (Z\,a\,\sqrt{2PQ} + Z\beta\,\sqrt{P1Q1 + P2Q2})^2}$$

$$(P1\text{-}P2)^2$$

$n=\frac{(1.96\sqrt{2(1)(0)}+0.842\sqrt{(-5.5)(6.5)+(7.5)(-6.5)^2}}{(-5.5-7.5)^2} = 18$

By estimating the dropout rate of 10%, the sample size becomes:

From the calculation above, the minimum sample size is 20 cases with a ratio of 1:1 between the case and control samples. The sample consists of 20 control groups and 20 case groups. By estimating the dropout rate of 10%, the sample size becomes:

$n = \frac{1 \times n}{1-F} = \frac{1 \times 18}{1-0.1}$

n1 = 20

The sample used was 40 people divided into two groups, namely control and intervention. The sampling technique used purposive sampling with inclusion criteria, namely primigravida, full-term pregnancy (≥37 weeks), single pregnancy with head presentation, and no pregnancy complications. Exclusion criteria were mothers with medical or obstetric conditions that required special treatment during labor.

treatment is carried out through pelvic shaking movements, while the use of Birth Ball is carried out in accordance with the Standard Operating Procedure (SOP) , namely the mother sits on the ball under the supervision of a midwife, and makes rotating or backward movements slowly during the active phase of labor. The research procedure begins with determining the control and treatment groups. Respondents in the treatment group were given Pelvic Rocking and Birth Ball interventions during the active phase II. Furthermore, the time was recorded in the second period, namely from complete cervical dilation until the baby was born, in both groups. The baby's APGAR score was recorded at 5 and 10 minutes after birth using a standard observation sheet. The measuring instruments used were observation sheets and partographs which were used to record the time of delivery and the results of observations of newborns. Data analysis used univariate tests for respondent characteristics while bivariate tests used Mann-Whitney because the data were not normally distributed. This research has received approval from the research ethics committee of the Faculty of Public Health, Hasanuddin University on October 28, 2024 with the number: 3157/UN4.14.1/TP.01.02/2024.

3. RESULTS

Table 1. Respondent Characteristics

Characteristics	Category	Intervention n	%	Control n	%
Mother's Age (years)	20–25	11	55.0	10	50.0
	26–30	4	20.0	4	20.0
	≥ 31	2	10.0	3	15.0
	Total	**20**	**100.0**	**20**	**100.0**
Parity	Primipara	20	100.0	20	100.0
Anxiety Level	Normal	17	85.0	12	60.0
	Light	1	5.0	1	5.0
	Keep	1	5.0	4	20.0
	Heavy	1	5.0	3	15.0
	Total	**20**	**100.0**	**20**	**100.0**

*Frequency distribution

Based on table 1, the characteristics of the respondents were obtained that the majority of mothers were aged 20-25 years in both groups (intervention 55.0 and control 50.0) which indicates that respondents tend to be young mothers. The parity characteristics in this study were that all respondents were **primiparous mothers,** while the characteristics of normal anxiety levels were found more in the intervention group (85.0) than in the control group (60.0). Conversely, moderate to severe anxiety was found more in the control group. This may indicate that intervention has the potential to reduce maternal anxiety levels before childbirth which in turn can have an impact on better delivery outcomes.

***Shapiro-Wilk* Normality Test**

Variables	Group	Statistics	df	Signature (p)	Interpret
Phase II (minutes)	Intervention	0.857	20	0.007	Abnormal
Phase II (minutes)	Control	0.930	20	0.155	Normal

*** *Shapiro-Wilk* Normality Test**

the Shapiro-Wilk normality test obtained a statistical value of 0.857 in the intervention group and 0.930 in the control group, each of which had a sample size (df) of 20. The significance value (p-*value)* in the intervention group was 0.007 (<0.05) which indicated that the data was not normally distributed. While in the control group with *a p-value* = 0.155 (>0.05) means that the data is normally distributed. Because one of the groups did not meet the normality assumption, the analysis was continued using a nonparametric test (Mann-*Whitney)* to compare differences between groups.

Normality test was not performed on the APGAR variable because it uses an ordinal scale. The normality test is only suitable for continuous numerical data, while the APGAR score describes clinical conditions in stages. Therefore, the analysis of differences in APGAR scores was carried out directly using the *Mann-Whitney test.* The statistical test used to see the effect of *the Pelvic Rocking and Birth Ball methods* on the length of Period II and the APGAR Score value in the intervention and control groups, namely using the *Mann-Whitney test,* can be seen in table 3.

Table 3. Effect of Pelvic Rocking and Birth Ball Methods on Duration of Period II and APGAR Score Values

Variables	Group	N	Mean rank	Sum of Ranks	U	Z	P (Asymp. Sig. 2-tailed
Phase II (minutes)	Intervention	20	10.50	210,000	0.000	-5.426	0.000
	Control	20	30.50	610,000			
Apgar 5	Intervention	20	19.77	395.50	185,500	-0.422	0.673
	Control	20	21.23	424.50			
Apgar 10	Intervention	20	18.80	376.00	166,000	-1.088	0.277
	Control	20	22.20	444.00			

*** Man-Whitney test.**

Table 3 Based on the results of the *Mann-Whitney test* on the variable of the length of period II between the intervention group and the control group, the following results were obtained: U value = 0.000, Z = -5.426, and p = 0.000 (p < 0.05). These results indicate that there is a statistically significant difference between the two groups. The intervention group has a mean rank value of 10.50, while the control group has a mean rank of 30.50. The number of ranks in the intervention group is 210.00, while in the control group it is 610.00. The lower mean rank value in the intervention group indicates that respondents in this group consistently have a shorter time to reach phase II compared to the control group.

The U value = 0.000 indicates that all participants in the intervention group had a faster time to reach the second stage compared to all participants in the control group. Meanwhile, the Z value = -5.426 which is very far from zero and has a negative sign indicates the direction and strength of the difference between groups, with the negative direction indicating that the intervention group has a lower value. Thus, it can be concluded that the intervention given in this study has been proven to be able to shorten the duration of the second stage of labor significantly, this shows that the method or treatment given to the intervention group is effective in accelerating the second stage of labor.

Meanwhile, the results of *the Mann-Whitney test* on the first 5-minute APGAR score showed a value of U = 185.500, Z = -0.422, and p = 0.673 (p > 0.05). This value indicates that there is no significant difference between the intervention group and the control group. The intervention group had a mean rank of 19.77, while the control group had a mean rank of 21.23. The two values are quite close, indicating that the 5th minute APGAR scores in both groups are relatively the same. Thus, it

can be concluded that the intervention did not affect the condition of the newborn as assessed by the 5th minute APGAR score. This can occur because the APGAR score is more influenced by other factors such as the condition of the fetus before delivery, the use of analgesics, and the physiological adaptation of the baby at birth.

Likewise, in the 10th minute APGAR value, the *Mann-Whitney test results* showed a U value = 166,000, Z = -1,088, and p = 0.277 (p > 0.05). Similarly, in the 5th minute, no significant difference was found between the intervention group and the control group. The mean rank value in the intervention group was 18.80, and in the control, group was 22.20. Although there was a slight difference, it was not statistically significant. So, the intervention did not have a significant effect on the 10th minute APGAR value. The 10th minute APGAR value describes the condition of the baby after early postnatal adaptation, and usually remains within normal limits if there are no complications.

4. DISCUSSION

1. Effectiveness of Pelvic Rocking and Birthball in the Second Stage

The results of this study indicate that *the Pelvic Rocking* and *Birth Ball methods* have proven effective in accelerating second-stage labor. Pelvic rotation and sitting on the ball facilitate the descent of the fetal folds to the pelvic floor, accelerate dilation, and help the mother push more effectively. Physical activity carried out consciously during the labor process also helps the mother feel more comfortable and in control, reduces anxiety, and increases the mother's confidence during the labor process. This study is in line with the results of research (Setyorini et.al. 2021) which states that rhythmic pelvic movements can help the progress of labor because they help adjust the position of the fetus to the birth canal, and increase the effectiveness of uterine contractions. This makes the process of lowering the fetal head and opening the birth canal efficient. Research (Gemini, 2019) also emphasizes the importance of the upright position obtained when sitting on a birthball, which can help maximize the force of gravity to help the fetus descend. In addition, sitting on a gym ball allows the mother to regulate her breathing and posture better, thereby increasing the effectiveness of pushing.

Research (Darma et al 2021) and (Wiliandari and Sagita 2021) also show that birthball can reduce pain, increase fertility, and facilitate the birthing process because blood flow in the uterus, placenta, and baby increases. This active movement also stimulates the release of endorphins which function as natural analgesics for the body. The use of this method also encourages an active and non-pharmacological approach in handling the procedure, which is considered safer and friendlier for the mother and fetus.

2. Effectiveness of Pelvic Rocking and Birthball on APGAR Score

The APGAR score is one of the important indicators in assessing the baby's adaptation to life outside the womb. In this study, although the APGAR score in the intervention group was slightly better descriptively, the results of the statistical analysis did not show any significant difference between the intervention group and the control group. This fact shows that the shorter duration of phase II is not always directly proportional to the increase in the APGAR score. This is because many factors affect the APGAR score, including the health condition of the fetus before delivery, the use of drugs during delivery, immediate treatment after the baby is born, and environmental factors such as the temperature of the delivery room and the skills of health workers. Research from Khoiriah & Pratiwi (2019) stated that the APGAR score is more influenced by the condition of the fetus and postpartum resuscitation actions than just one variable of the labor process such as the length of the second stage. Therefore, the APGAR score cannot be used as the only parameter to assess the success of the Pelvic Rocking and Birth Ball methods. However, the absence of a significant difference in APGAR scores also provides another advantage, namely that this method can accelerate labor without endangering the condition of the newborn.

Although the intervention in this study significantly reduced the duration of labor, there was no significant difference in APGAR scores between the intervention and control groups. Several factors may explain this finding. First, APGAR scores are influenced by multiple factors, including fetal condition before birth, newborn adaptation after birth, use of medications during labor, and the skills of health workers assisting with delivery. Second, the intervention primarily targeted mothers rather than newborns, so its direct impact on neonatal outcomes may have been limited. Third, APGAR scores ranged within a narrow range (0–10), and most newborns in this study were likely born in good condition, so small differences are difficult to detect statistically. Finally, the limited sample size (n = 20 per group) may have reduced the statistical power to detect small differences in APGAR scores.

Conflict of Interest

There isn't any

Conclusion

Pelvic rocking and *birth ball* have been shown to be effective in significantly reducing the duration of the second stage of labor through biomechanical and neuroendocrine mechanisms. These interventions facilitate pelvic expansion, fetal head descent and rotation, while stimulating the release of endogenous oxytocin and endorphins to enhance uterine contractions and reduce maternal pain perception. However, they did not significantly affect neonatal APGAR scores, possibly due to the

influence of other factors such as fetal condition in the womb, postpartum adaptation, obstetric interventions, and provider competence. Given the benefits of sharing labor outcomes, midwives are advised to include these techniques as part of a physiological labor management strategy to improve maternal care and contribute to the reduction of maternal and neonatal morbidity and mortality.

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