

# Biomechanical effects of birth ball exercises on reducing back pain in Pregnant Women

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**Abstract.** Low Back Pain can appear in the posterior iliac crest area and the gulteus fold or around the waist. The incidence of low back pain in pregnant women is 50% to 90%, one third will experience severe pain that will affect the quality of life during pregnancy. Low back Pain is the most common cause of leave during pregnancy. Birth Ball Exercise is a non-pharmacological method that can reduce low back pain in pregnant women. This research aims to indicate effectiveness of Birth Ball Exercise on reducing Low back pain in the pregnancy phase by measuring the degree of pain before doing Birth ball exercise and measuring pain again after doing Birth ball exercise with a measuring tool used using NRS. Experimental with a quasi-experimental approach conducting pre- and post-test treatment of two groups design. The subjects of this study were pregnant women in their second and third trimesters aged 14-40 weeks with a sample size of 30 people who were randomly divided into two groups. The results birth ball exercise on reducing pain in low back pain in the second and third trimesters of pregnancy.

## 1 Introduction

Pregnancy causes significant physical and emotional adjustments in women. Physical changes include weight gain, hyperpigmentation, and an enlarged uterus and abdomen. Psychological changes include low self-confidence, feelings of displeasure at premature birth, excessive worry about pain during labor, concerns about the baby being born with an imperfect condition, concerns about the mother's safety and well-being, and discomfort experienced during pregnancy [1].

Around 49% of pregnant women in Indonesia, particularly those aged 40 years and over, experience back pain during pregnancy. However, Despite the high occurrence of back pain during pregnancy, approximately 80–90% of women experiencing it do not seek medical treatment, meaning only 10 to 20% seek medical treatment [2].

Variation in the prevalence of back pain has been observed among pregnant women worldwide. Studies conducted in 2018 and 2019 revealed that between 20% and 90% of pregnant women in countries such as Europe, Canada, the United States, Nepal, and several African regions complain of lower back pain. Walking or sitting for long durations often becomes difficult, as this condition interferes with routine activities [3].

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In Indonesia, lower back pain affects an estimated 18% of women during pregnancy, with the prevalence increasing with age, particularly in older women. Lower back pain of varying intensity was reported by twelve pregnant women in one particular study: 4 (33.3%) experienced tolerable pain, one (8.3%) experienced mild, unpleasant pain, and 3 (25%) reported very intense pain that interfered with other senses [4]. Surveys conducted at several hospitals in the Sleman area of Yogyakarta show that a consistent monthly increase of approximately ten cases in the number of pregnant women seeking physiotherapy treatment for lower back pain over the last two years.

During pregnancy, the mother experiences significant physiological and anatomical changes. As the fetus grows, the mother's body weight also increases, which alters the body's center of gravity. As weight increases, changes in posture occur in an effort to maintain balance. One of the most common changes is an increased curvature of the spine, which can affect the lumbar and pelvic areas. These changes aim to adapt the body to support the increased weight during pregnancy [5]. Furthermore, the position of a pregnant woman's pelvis will widen and change as the pregnancy progresses, differing from the position before pregnancy. In Indonesia, the most common physiotherapy modalities used by physiotherapists to treat this problem include massage, infrared therapy or warm compresses, and prenatal exercises. The prenatal exercises consist solely of breathing and stretching exercises, with no active movements.

One non-pharmacological therapy for third trimester that able to decreasing lower back pain is exercise using a birth ball. Light exercise using the ball can stimulate postural reflexes and assist in maintaining the muscular strength that stabilizes and supports the spinal column. One movement is sitting on the ball and shaking the pelvis, which has been shown to provide comfort to the lower back through a gate control mechanism.

In addition to its benefits in reducing back pain, utilizing a birth ball may help enhance the progression of the first stage of labor. By utilizing gravity, these exercises help release endorphins, which increase maternal comfort. Sitting on the ball and rocking the pelvis stimulates receptors in the pelvic area, which also accelerates labor [6]. During birth ball exercises, the pregnant woman's body is stimulated by certain movements that stimulate receptors in the body, ultimately helping to reduce muscle tension in the spine and reduce pain. Furthermore, these exercises strengthen the body's stabilizing muscles, such as the multifidus, erector spinae, and abdominal muscles, which are important for reducing muscle imbalances and helping pregnant women experiencing lower back pain [7].

## **2 Methods**

This study employed a quantitative research design with a pre-test and post-test two-group experimental design. The sample size was 30 people, divided into two groups with different treatments: group 1 receiving birth ball exercise and group 2 as the control group (not given any intervention). The aim of this study was to evaluate the effect of birth ball exercise on reducing low back pain during pregnancy. The subjects were 30 pregnant women aged 25 to 35 years in their second and third trimesters (determined based on exclusion and inclusion criteria). The inclusion criteria were willingness to be respondents, mothers in their second and third trimesters, and diagnosed with myogenic low back pain through specific examinations.

## **3 Results and discussion**

### 3.1 Result

Analysis of respondent characteristics, including maternal age, gestational period, and BMI revealed that participants were aged 20–30 years, where group 1 is dominated by ages 20 to 35 years (60%) while in group 2 is dominated by ages 26 to 30 years (66.6%). The gestational age of respondents in this study ranges from 14-40 weeks, where cows are dominated by gestational ages of 14 to 27 weeks (73.3%) while in group 2 are dominated by gestational ages of 14 to 27 weeks (66.6%). The BMI of respondents in this study is categorized as normal, overweight and obese, where respondents in group 1 are dominated by overweight BMI (60.0%) while group 2 are dominated by overweight BMI (53.3%)

**Table 1.** Respondent Characteristics

Description	Groub I (Brith Ball)		Groub II (Control)	
	Frequency	Percentase	Frequency	Percentase
<b>Age</b>				
20 – 25	9	60 %	10	66,6 %
26 – 30	6	40 %	5	33,3 %
<b>Gestational Age</b>				
14 weeks – 27 weeks	11 4	73,3 % 36,3	10	66,6 %
28 weeks – 40 weeks	4 11	36,3 % 73,3	5	33,3 %
<b>IMT</b>				
Normal	3	20 %	4	26,6 %
Overweight	9	60%	8	53,3%
Obesitas	3	20%	3	20 %

The results of processing pain scores using the NRS both before and after birth ball exercise treatment using a paired simple t-test in group 1 yielded a p-value of 0.000, confirming that the use of birth ball exercises can reduce lower back pain during pregnancy.

Results of processing pain scores using the NRS both before and after birth ball exercise treatment using a paired simple t-test in group 2 hypothesis testing produced a p-value of 0.267, implying birth ball exercise wasn't effective in reducing lower back pain during pregnancy.

**Table 2.** Analysis Results

Influence Test Results	N	P
Brith Ball Groub	15	0,000
Control Groub	15	0,267

An independent sample t-test was conducted to compare the effect of birth ball exercise with the control group, yielding a p-value of 0.000. This result indicates a significant difference between the two groups, suggesting that birth ball exercise effectively reduces lower back pain in pregnant women.

**Table 3.** Difference Test Results

Different test Results	N	P
Brith Ball Groub and control Groub	15	0,000

### 3.2 Discussion

The age distribution in Table 1 shows that women under 30 years of age are also more likely to experience lower back pain. This is due to several factors, including heavy activity, which requires greater bone and muscle coordination, which can lead to injury to certain nerves or muscles, ultimately leading to lower back pain. Furthermore, awkward

and unsupportive positions can lead to excessive stretching. Prolonged inactivity also significantly impacts pregnancy, as it requires activities that stimulate muscles and joints sufficiently, but not excessively [9].

Lower back pain during pregnancy can be affected by various factors, including the gestational age of the mother. When a pregnant woman reaches 30 weeks of gestation, changes in the body's center of balance occur due to a shift in the spine and pelvis, which shifts forward, causing the waist to become more curved [10].

**BMI Descriptive** The respondents in this study were predominantly overweight in both groups. Women with an abnormal BMI (overweight) tend to have excess weight, which can result in additional stress on the back, which can put pressure on the muscles and ligaments around the back, which can cause to back pain and predispose pregnant women to bone abnormalities such as scoliosis. This condition can cause additional stress on the spine, which can lead to back pain during pregnancy [11].

A p-value of 0.000 was obtained from the paired sample t-test, suggesting that Birth Ball Exercise had a significant effect on decreasing lower back pain among pregnant women. From the control group analysis, a p-value of 2.67 was found, indicating that low back pain was not able to affect the condition of pregnant women. The comparison test between the two groups produced a p-value of 0.000, showing that there was a significant difference between them. Therefore, it can be concluded that birth ball exercise was found to be effective in alleviating lower back pain among pregnant women in their second and third trimesters [7].

Birth ball exercises are crucial for pregnant women, as they can reduce low back pain by strengthening all the muscles of the spine. The movement of the birth ball, which involves shaking the ball, can increase comfort for pregnant women due to the gate control mechanism [12]. This is in line with the body's adaptation mechanisms for pregnant women due to the anatomical changes that occur, including an enlarged uterus and an enlarged abdomen, which increases the risk of lumbar lordosis and sacroiliac joint instability. This puts pressure on the spinal muscles in the back area, such as ligaments, which can lead to back pain [13].

Birth ball exercises themselves are useful for stimulating reflexes and stimulating receptors that are useful for women during pregnancy who experience this pain, when pregnant women do movements on the ball such as shaking the ball to the front and back with an upright posture, this can stimulate postural reflexes in the body so that the movements of this exercise can continue to maintain the muscles that support the spine in pregnant women who experience anatomical changes [14]. In addition, the benefits of the movements of shaking the ball to the front and back during Birth ball exercises carried out during this exercise can create comfort in pregnant women. So that the pregnant woman's body can stimulate endorphin hormone receptors in the body. The function of the stimulation to activate postural reflex stimulation and hormone receptors makes the pregnant woman's body reduce muscle tension that occurs in the muscles that support the spine. The benefits that occur are reducing the production of stress hormones in pregnant women and increasing metabolism. The decrease in these hormones will affect the body condition of pregnant women so that the body becomes healthier and full of energy for strengthening, rejuvenation and healing [15].

## 4 Conclusion

The results of a study entitled "The Effectiveness of Birth Ball Exercises in Reducing Low Back Pain During Pregnancy" concluded that during the second and third trimesters of pregnancy, lower back pain can be effectively reduced through birth ball exercises. As an

alternative therapy, birth ball exercises can effectively help reduce lower back pain experienced by women during the second and third trimesters of pregnancy.

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