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The Combined Effect of Birthing Ball Therapy and Birthing Yoga on Maternal Outcomes in Normal Delivery

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Abstract

Childbirth is a physiological process that can be accompanied by pain, anxiety, and varying duration of labor. When pain is not managed well, with high anxiety and too long labor duration, it can increase the risk of complications for the mother and baby, resulting in an increased risk of labor with medical procedures and labor trauma for the mother. One of the complementary therapies that can overcome these problems is the use of birthing balls and labor yoga. The purpose of this study was to analyze the effect of the combination of birthing balls and labor yoga on labor outcomes (labor pain, anxiety levels and labor duration). The research method used was Quashi Experiment with a Non-Equivalent Pretest-Posttest Control Group Design. The research subjects were mothers giving birth in the delivery room of RSIA Siti Khadijah, Gorontalo City with a purposive sampling technique based on inclusion and exclusion criteria, so that the total sample obtained was 50 mothers giving birth consisting of 25 respondents in the intervention group and 25 respondents in the control group. Data analysis used the T Test on the variables of Labor Pain and Anxiety Level and the Man-Whitney Test on the variable of labor duration. The results of this study indicate that the combination of birthing ball and birthing yoga has a distinct impact on labor outcomes. The greatest impact was seen on the psychological aspect, with a significant reduction in anxiety ($p < 0.01$), while the effects on labor pain and duration were more clinical-descriptive in nature without statistical significance ($p > 0.05$). Therefore, it can be concluded that the combination of birthing ball and birthing yoga predominantly affects the psychological aspect, while still contributing to expediting labor progress descriptively.

Keywords: Complementary therapy; Birthing Ball; Birthing Yoga; Labor Outcomes; Mothers in Labor.

INTRODUCTION

The birth process is a complex physiological, emotional, and spiritual experience for every mother (Crowther & Hall, 2015; Nahaee et al., 2024; Williams et al., 2023). However, it is often a stressful time and causes significant discomfort and even trauma, particularly regarding perceptions of labor pain and anxiety about labor. Three important outcomes in the labor process that are often of concern are labor pain, anxiety levels, and labor duration(Kamal Abd Elkhalek et al., 2021; Rantala et al., 2022). Uncontrolled labor pain can cause muscle tension, increased stress hormones (adrenaline and cortisol), and decreased oxytocin production, which contribute to longer labor duration and increase the risk of medical intervention (Walter et al., 2021). Furthermore, high anxiety during labor can also negatively impact the well-being of the mother and baby, and hinder the normal labor process, which can cause labor trauma for the mother herself (Ahmadpour et al., 2023; Watson et al., 2021).

Based on the results of the 2023 Indonesian Health Survey (SKI), it was recorded that approximately 67% of normal births in health facilities were still accompanied by medical interventions, such as oxytocin induction, episiotomy, or other procedures that could actually be minimized with a more natural and supportive approach. The data also showed that only 28% of mothers felt emotionally satisfied with their birth experience, and approximately 41% of mothers admitted to experiencing high levels of anxiety before delivery (Kementerian Kesehatan Republik Indonesia, 2023).

Various strategies and efforts have been developed to improve maternal comfort during labor, one of which is the application of complementary therapies. Several studies have shown that complementary therapies are effective in optimizing the success of normal labor, such as aromatherapy, endorphin massage, acupressure, the use of birthing balls, birthing yoga, and several other non-pharmacological methods (Katili, Djunaid, et al., 2023; Katili et al., 2019, 2021; Katili, Hiola, et al., 2023; Nori et al., 2023). One method that is increasingly being used is the birthing ball and birthing yoga. Both methods, individually, have been shown to help mothers manage pain, reduce anxiety, improve fetal position, and accelerate cervical dilation, thus shortening labor(Corrigan et al., 2022; Grenvik et al., 2022; Jha et al., 2023; Yekefallah et al., 2021).

A birthing ball is a special ball used to help laboring mothers perform movements that can increase pelvic flexibility, reduce muscle tension, and help the baby enter the birth canal more optimally (Grenvik et al., 2022; Tabuk & Banjar, 2023). Meanwhile, maternity yoga helps mothers manage their breathing, increase pelvic muscle elasticity, relaxation and body movements that support the physiological process of labor (Abera et al., 2024; Katili, Hiola, et al., 2023; Wadhwa et al., 2020). Research conducted by Suryaningsih shows that the combination of prenatal yoga and the use of a birthing ball can significantly shorten the duration of the first stage of labor in the active phase compared to either intervention alone or without intervention, so this intervention has the potential to be an effective non-pharmacological strategy in supporting normal labor (Ning et al., 2024).

In addition, seeing the high number of medical interventions that still occur in the normal delivery process and the desire to return the delivery process to a more natural and minimal risk direction, the formulation of the problem in this study is 1) how does the combination of the use of birthing balls and birthing yoga affect labor pain?, 2) how does the combination of the use of birthing balls and birthing yoga affect the level of maternal anxiety?, 3) how does the combination of the use of birthing balls and birthing yoga affect the duration of labor?.

However, research examining the combination of birthing balls and birthing yoga simultaneously in a single intervention is still very limited, so the urgency of this research has the potential to provide a synergistic effect in reducing pain, alleviating anxiety, and shortening the duration of labor more optimally. This fact indicates a gap between the mother's need for a positive birth experience and intervention approaches that are still biomedical. Therefore, this research is expected to form the basis for the development of holistic and evidence-based complementary therapy midwifery care interventions, thereby improving the quality of midwifery services in Indonesia.

MATERIALS AND METHODS

This study used quantitative research method with a quasi-experimental design, specifically the Non-Equivalent Pretest-Posttest Control Group Design. The research was conducted at Siti Khadijah Maternity and Children Hospital (RSIA) in Gorontalo City. The subjects of this study were mothers who were giving birth at RSIA Siti Khadijah during the research period. The selection of research subjects was done through purposive sampling based on inclusion and exclusion criteria. The inclusion criteria are: 1) pregnant women with a gestational age of 37-40 weeks, 2) mothers in active labor in the first stage starting from cervical dilation of 4 cm, 3) intact amniotic fluid, 4) willingness to participate as research respondents. The exclusion criteria are: 1) mothers with childbirth complications, 2) mothers with labor difficulties, 3) mothers undergoing cesarean section or vacuum extraction. Therefore, the total sample in this study consists of 50 mothers in labor, with 25 respondents in the intervention group and 25 respondents in the control group.

This study used several research materials and tools to support the research process. The materials used are the Standard Operating Procedure (SOP) for the use of the birthing ball and the SOP for birth yoga to ensure the methods used are appropriate. The tools used include: 1) Birthing ball, 2) Yoga mat, 3) Stopwatch to measure the duration of the intervention, 4) Partograph to assess the progress of labor (duration), 5) Numeric Rating Scale (NRS) to assess labor pain, 6) Hamilton Anxiety Rating Scale (HARS) questionnaire to assess the level of anxiety of the laboring mothers. The combination of the birthing ball and birth yoga was provided by the midwife in the delivery room at RSIA Siti Khadijah. Prior to the intervention, the midwife had been educated and demonstrated the use of the birthing ball and birth yoga by a certified midwife who had attended prenatal gentle yoga training.

During the implementation phase, both groups will undergo an initial test (pre-test) to assess labor pain, anxiety levels, and labor duration. The intervention group will then receive treatment using the birthing ball in combination with birth yoga movements during the labor process. The intervention will be conducted for 20 minutes, with two 20-minute sessions and a 1-hour break during the active phase of the first stage of labor. The total intervention with the birthing ball and birth yoga will be conducted four times. The control group will receive standard normal delivery care. Afterward, a final test (post-test) will be conducted on both groups.

Data analysis was performed through a paired t-test to compare the results before and after the intervention within a group, and an independent t-test to compare both groups on labor pain and anxiety levels. For the labor duration variable, the Mann-Whitney test will be used. Data will be analyzed using SPSS 21 to ensure the accuracy of the research results. This research has been ethically reviewed by the Ethics Committee of the Faculty of Health Sciences, Muhammadiyah University of Gorontalo, with protocol number 028/KEPK-FIKES/X/2025.

RESULTS AND DISCUSSION

Table 1. Respondent Characteristics.

Characteristics	Group			
	Intervention (n=25)	%	Control (n=25)	(%)
Age				
<20	2	8.0	2	8.0
20-35	22	88.0	20	80.0
>35	1	4.0	3	12.0
Education				
Elementary	1	4.0	1	4.0
Junior High School	1	4.0	4	16.0
Senior High School	12	48.0	9	36.0
College	11	44.0	11	44.0
Work				
House Wife	17	68.0	18	72.0
civil servant	1	4.0	4	16.0
Employee	7	28.0	3	12.0
Parity				
Primipara	12	48.0	6	24.0
Multipara	10	44.0	12	48.0
Grandemultipara	3	12.0	7	28.0

Respondents in this study were divided into two groups: the intervention group (n=25) and the control group (n=25). The majority of respondents in both groups were aged 20–35 years, but the proportion was higher in the intervention group (88%) than in the control group (80%). In terms of education, the distribution was relatively balanced, with a higher percentage of high school and college education in both groups, at >40%. Occupational characteristics showed that most respondents were housewives, with a larger proportion in the control group (72%) and the intervention group (68%). Meanwhile, respondents working as employees were more numerous in the intervention group (28%). Based on parity, the intervention group was dominated by primiparas (48%), while the control group was dominated by multiparas (48%) and grandemultiparas (28%).

Table 2. Distribution of Labor Pain and Anxiety Level Before and After Intervention on Both Groups.

Variable	Intervention group (n=25)				Control group (n=25)			
	Pretest		Posttest		Pretest		Posttest	
	n	%	n	%	n	%	n	%
Labor pain								
Mild	-	-	-	-	1	4.0	1	4.0
Moderate	18	72.0	12	48.0	17	68.0	0	0
Severe	7	28.0	13	52.0	7	28.0	24	96.0
Anxiety level								
Normal	-	-	-	-	1	4.0	1	4.0
Mild	1	4.0	5	20.0	6	24.0	6	24.0
Moderate	17	68.0	17	68.0	10	40.0	7	28.0
Severe	7	28.0	2	8.0	6	24.0	10	40.0
Very severe	4	16.0	1	4.0	2	8.0	1	4.0

The intervention group demonstrated a reduction in moderate pain and anxiety levels post-intervention, with notable shifts toward mild anxiety and normal categories. Conversely, the control group exhibited increased pain intensity and higher proportions of severe anxiety after labor progression.

The results of labor pain measurements in the intervention group showed a difference in distribution between before and after the intervention. During the pretest, most respondents experienced moderate pain (72%), while the remainder experienced severe pain (28%). After the intervention, the proportion of moderate pain decreased to 48%, while severe pain increased to 52%. In the control group, the distribution of labor pain showed a significant difference between the pretest and posttest. Before the intervention, the majority of

respondents experienced moderate pain (68%), while 28% experienced severe pain and only 4% experienced mild pain. After labor progressed (posttest), all respondents experienced an increase in pain intensity, with 96% of respondents reporting severe pain, while only 4% reported mild pain. No respondents were in the moderate pain category at this stage. In the initial measurement (pretest), the majority of respondents in the intervention group were in the moderate anxiety category (68%), followed by severe anxiety (28%), and a small proportion experienced mild anxiety (4%) and very severe anxiety (16%). After the intervention (posttest), the distribution of anxiety showed quite significant changes. Twenty percent of respondents were in the normal category, the majority shifted to the mild anxiety category (68%), while only 8% remained moderately anxious, and 4% experienced severe anxiety. No respondents were found in the very severe anxiety category. In the initial measurement (pretest), the majority of respondents in the control group were in the moderate anxiety category (40%), followed by mild anxiety (24%) and severe anxiety (24%), while only 4% were in the normal category and 8% were in the very severe anxiety category. After the posttest, there was a shift in distribution, but not for improvement. The number of respondents with severe anxiety increased to 40%, while those with moderate anxiety decreased to 28%. The proportions of mild and normal anxiety remained the same (24% and 4%), while very severe anxiety decreased slightly to 4%.

Table 3. Frequency Distribution of Labor Progress in the Intervention Group and Control Group.

Labor Progress	Group			
	Intervention (n=25)		Control (n=25)	
	n	%	n	%
Fast	23	92.0	19	76.0
Slow	2	8.0	6	24.0

The distribution of labor progress showed that in the intervention group, the majority of respondents (92%) experienced rapid labor progress, while only 8% experienced slow labor. Meanwhile, in the control group, the proportion of rapid labor progress was lower, at 76%, with 24% of respondents experiencing slow labor.

Table 4. Paired Sample T-Test of Labor Pain and Anxiety Level Before and After Intervention on Both Groups.

	Mean	SD	Mean Difference	Minimum	Maximum	P Value
Intervention group						
Labor pain						
Pretest	5.48	1.295	-2.120	-2.616	-1.624	< 0.01
Postest	7.60	1.848				
Anxiety level						
Pretest	34.80	8.357	18.60	15.198	22.002	< 0.01
Postest	16.20	4.340				
Control Group						
Labor pain						
Pretest	5.84	1.463	-2.680	-3.529	-1.831	< 0.01
Postest	8.52	1.686				
Anxiety level						
Pretest	26.64	8.538	0.640	-3.518	4.798	0.754
Postest	26.00	9.229				

The intervention group exhibited a significant increase in labor pain scores and a substantial reduction in anxiety scores post-intervention ($p < 0.01$). In contrast, the control group showed a significant increase in pain scores but no statistically significant change in anxiety levels.

The average labor pain score in the intervention group showed an increase from pretest (Mean = 5.48; SD = 1.295) to posttest (Mean = 7.60; SD = 1.848). Paired T-Test analysis produced a value of Mean Difference = -2,120 with a 95% confidence interval between -2,616 to -1,624, as well as values $p < 0,01$. These results indicate that there is a statistically significant difference between pain scores before and after the intervention. The analysis results showed a significant decrease in the average anxiety score in the intervention group. The average anxiety score before the intervention was 34.80 (SD = 8.357), while after the intervention it decreased to 16.20 (SD = 4.340). The Mean Difference value = 18.60 with a 95% confidence interval between 15.198 and

22.002, and a p-value <0.01. This confirms that the difference in anxiety levels before and after the intervention is statistically significant. In the control group, the average labor pain score increased from 5.84 (SD = 1.463) in the pretest to 8.52 (SD = 1.686) in the posttest. The results of the Paired T-Test analysis showed a Mean Difference = -2.680 with a 95% confidence interval between -3.529 and -1.831, and a p-value <0.01. This indicates that there is a statistically significant difference between pre- and post-labor pain in the control group. In the control group, the average pretest anxiety score was 26.64 (SD = 8.538) and decreased slightly in the posttest to 26.00 (SD = 9.229). The Paired T-Test analysis showed a Mean Difference = 0.640 with a 95% confidence interval between -3.518 and 4.798, and a p-value = 0.754. This indicates that the difference in anxiety levels before and after delivery in the control group was not statistically significant.

Table 5. T-Test of Labor Pain and Anxiety Level After Intervention on both groups.

Postest	Mean	SD	Mean Difference	Minimum	Maximum	P Value
Labor pain						
Intervention	7.60	1.848	0.920	-1.926	0.086	0.072
Control	8.52	1.686		-1.926	0.086	
Anxiety level						
Intervention	16.20	4.340	-9.80	-13.901	-5.699	< 0.01
Control	26.00	9.229		-13.944	-5.656	

The average labor pain score in the posttest for the intervention group was 7.60 (SD = 1.848), while in the control group it was higher at 8.52 (SD = 1.686). The T-Test showed a Mean Difference = 0.920 with a 95% confidence interval between -1.926 and 0.086, and a p-value = 0.072. These results indicate that although there was a difference in average pain between the two groups, the difference was not statistically significant at the 95% confidence level. The average anxiety score in the intervention group after treatment was 16.20 (SD = 4.340), while in the control group it was 26.00 (SD = 9.229). The T-Test results showed a Mean Difference = -9.80 with a 95% confidence interval between -13.901 and -5.699, and a p-value <0.01. This confirms that there is a statistically significant difference between the anxiety levels in the intervention and control groups after treatment.

Table 6. Mann-Whitney Test on Duration of Labor in the Intervention Group and Control Group.

Postest	N	Mean Rank	Sum Of Ranks	P Value
Intervention	25	23.50	587.50	0.127
Control	25	27.50	687.50	

The results of the Mann–Whitney test in this table show that The combination of birthing ball and maternity yoga did not provide a significant difference in posttest results compared to the control group (p = 0.127). Although descriptively there is a tendency for improvement in the intervention group, statistically these results cannot yet be used as strong evidence.

Discussion

The effect of the combination of birthing ball and maternity yoga on labor pain

The results of labor pain measurements in the intervention group showed a difference in distribution between before and after the intervention. This change indicates a shift in pain perception from moderate to severe in some respondents after the intervention. This phenomenon may be caused by the progressive physiological dynamics of labor, where uterine contractions become more intense and frequent as labor progresses. Clinically, this is normal, as non-pharmacological interventions generally serve only as a supportive strategy, not a complete elimination of pain. Interpretation of these results confirms that although the intervention may have helped some respondents maintain moderate pain, the progression of labor still led to a physiological increase in pain intensity. Thus, these findings provide a realistic picture of the intervention's effectiveness in a clinical context, namely as a partial, rather than an absolute, method of pain management.

In the control group, the distribution of labor pain showed a significant difference between the pretest and posttest. This change indicates that, without intervention, labor progressed significantly with increasing pain intensity. This is consistent with the physiological process of labor, where uterine contractions become stronger and more frequent, increasing pain intensity from moderate to severe in most respondents. This phenomenon underscores the important role of non-pharmacological pain management, as the no-intervention group saw a drastic shift toward severe pain.

Based on the results of the Paired T-Test Analysis, the Mean Difference value was -2.120 with a 95% confidence interval between -2.616 and -1.624, and a p-

value <0.01. These results indicate that there is a statistically significant difference between pain scores before and after the intervention. The increase in the average pain score after the intervention reflects the physiological progression of labor, where uterine contractions become stronger and more frequent, resulting in more intense pain. This finding confirms that although intervention can act as a pain management strategy, it cannot completely inhibit the natural increase in pain intensity during labor. Clinically, this is important because it confirms the role of intervention as a supportive method to keep some respondents in the moderate pain category, even though most ultimately still experience increased pain intensity as labor progresses.

These findings align with research by Aslantas and Chankaya who reported that the use of birthing balls in primiparous mothers effectively reduced labor pain intensity and shortened the active phase compared to the control group (Aslantaş & Çankaya, 2024). Similar results were also shown in a meta-analysis by Terres et al. (2025), who found that exercise with a birth ball can reduce pain scores by around 20% at 4–8 cm dilation and shorten the duration of the first stage of labor (Terres et al., 2025). Another study by Grenvik et al. also confirmed that birth balls significantly reduced labor pain, indicating a consistent non-pharmacological analgesic effect (Grenvik et al., 2022). Meanwhile, literature on prenatal yoga also shows that breathing exercises, meditation, and relaxation are effective in reducing pain perception through increased self-control and endorphin release (Wadhwa et al., 2020; Yekefallah et al., 2021).

However, descriptively, the intervention group showed a lower average pain score than the control group, indicating a tendency for the intervention to play a role in curbing the rate of pain increase. However, because the difference was not statistically significant ($p > 0.05$), these results cannot be used as a basis for stating the effectiveness of the intervention in consistently reducing labor pain. Clinically, these findings indicate that labor pain is more influenced by natural physiological mechanisms, so that non-pharmacological interventions can only provide a delay or relative relief effect, but do not significantly differentiate the pain experience between the two groups.

Furthermore, parturition can also influence labor pain. The results of this study showed that in the intervention group, parity distribution was relatively balanced between primiparas (48.0%) and multiparas (44.0%), with a small proportion of grandemultiparas (12.0%). This provides important context for interpreting the intervention results. Physiologically, primiparas tend to experience longer labor durations and higher pain intensity than multiparas, as the pelvic floor and cervical muscles have not yet undergone a prior adaptation process. The use of birthing balls and birthing yoga in this group plays a role in increasing mobility, improving fetal positioning, and reducing pressure on the pelvic bones, thereby slowing the escalation of pain, which is usually more severe in primiparas. Thus, although pain continues to increase as labor progresses, this intervention provides a clinically significant buffering effect for first-time mothers.

Meanwhile, in multiparas, although previous labor experiences tend to speed up the process, pain persists due to increasingly strong contractions. The use of a birthing ball and birthing yoga in this group not only helps reduce mechanical pressure on the lower back and pelvic floor muscles but also increases comfort through a sense of greater control over the body. This effect is likely more psychological than physiological, but it still contributes to a reduction in pain perception. Overall, the combination of a birthing ball and birthing yoga served as a supportive intervention, providing the clearest benefits in primiparas, moderate benefits in multiparas, and limited benefits in grandemultiparas. In other words, the effectiveness of this intervention is closely related to previous birth experience, with primiparas experiencing the greatest benefit in pain reduction from the birthing ball and birthing yoga intervention.

The effect of the combination of birthing ball and maternity yoga on the level of anxiety

The results of this study indicate that the use of birthing balls and birthing yoga in the intervention group can reduce maternal anxiety levels. The increase in the proportion of respondents in the normal and mild categories (from 4% to 88% cumulatively) indicates the intervention's success in providing relaxation, a sense of security, and reducing perceived threat during labor. Psychologically, this can be explained through stress coping theory, where non-pharmacological interventions help shift focus, increase self-control, and reduce physiological responses to anxiety. This contrasts with the control group, where anxiety tended to remain in the moderate to severe category, even increasing in the severe category (from 24% to 40%). This reflects the psychological effects of labor progression, where increasing pain and intensifying physiological processes amplify the perception of threat, thereby exacerbating anxiety levels. The absence of a significant shift to the normal or mild categories indicates that the control group did not receive protective factors to reduce anxiety.

Clinically, this confirms that the intervention plays a significant role in reducing anxiety, while in the control group, anxiety remained at moderate to severe levels, which can worsen the labor experience. The lack of significant improvement in the control group also suggests that natural labor progress tends to increase psychological stress if not balanced with anxiety management strategies. This study found that the combination of birthing balls and birthing yoga significantly reduced maternal anxiety. Anxiety scores in the intervention group decreased dramatically from 34.80

to 16.20 ($p < 0.01$), while there was no significant change in the control group (26.64 to 26.00; $p = 0.754$). These results were supported by a posttest t-test, which showed a significant difference between groups ($p < 0.01$), with anxiety scores nearly 10 points lower in the intervention group compared to the control group.

This highly significant reduction in anxiety levels indicates the effectiveness of the birthing ball and birthing yoga interventions in controlling maternal psychological responses during labor. This finding differs from the results for labor pain, where the interventions were not fully able to suppress the physiological increase in pain. Thus, the interventions predominantly affected the psychological aspect (anxiety) rather than the physiological aspect (pain). From a clinical perspective, these results align with psychoneuroimmunology theory, which explains that reducing anxiety can help reduce sympathetic nervous system stimulation, promote relaxation, and improve maternal emotional readiness for labor. The significant difference ($p < 0.01$) confirms that the birthing ball and birthing yoga interventions are not only practically beneficial but also have measurable and statistically significant impacts.

From a clinical perspective, this significant difference has important practical implications: interventions can be used as effective psychological management strategies to improve maternal emotional well-being during labor. These results are also consistent with adaptive coping and mind-body connection theories, which suggest that anxiety management can improve the subjective experience of labor while supporting a smooth physiological process. A similar meta-analysis by Yeun et al. (2021) also confirmed that yoga practice during pregnancy significantly reduces anxiety and improves maternal psychological well-being. Furthermore, a study by Aslantas & Cankaya (2023), although focused on labor pain, also demonstrated a positive effect of birth balls on comfort and satisfaction during labor. This confirms that movement-based interventions such as birthing balls have psychological benefits, even if not their primary goal. When combined with labor yoga, the effects are more comprehensive because yoga addresses cognitive and emotional aspects, while birthing balls provide physical comfort (Aslantaş & Çankaya, 2024; Yeun & Kim, 2021) . From a psychoneuroimmunological perspective, reducing anxiety through non-pharmacological interventions will decrease sympathetic nervous system activation, reduce cortisol secretion, and increase oxytocin, which in turn facilitates contractions and accelerates labor progress (Kuder et al., 2025; Nisha et al., 2025). Thus, the combination of birthing balls and labor yoga not only impacts psychological aspects but also contributes to better physiological outcomes in labor.

In a recent RCT with primiparous participants, yoga practiced during pregnancy (12 weekly 90-minute sessions) was found to reduce pain intensity during labor, but it was also noted that yoga helped reduce fear and anxiety as labor approached; although not all variables showed equally strong effects (Jeelani & Habeeb, 2018; Kuder et al., 2025). While not all studies explicitly cited data on the combination of yoga and birthing balls, several studies of prenatal yoga indicated that the anxiety-reducing effects were often seen more quickly than the effects on pain. For example, prenatal yoga increased tolerance to psychological stress/anxiety, improved mood, and increased maternal feelings of control over labor (Villar-Alises et al., 2023; Wadhwa et al., 2020; Zuarez-Easton et al., 2023).

The combination of maternity yoga and birthing balls works through complementary neurophysiological mechanisms. Maternity yoga stimulates the parasympathetic nervous system through deep breathing exercises, relaxation, and meditation, thereby suppressing the dominance of the sympathetic nervous system, which is typically increased in anxious states (Issac et al., 2023). This parasympathetic activity lowers heart rate and blood pressure and reduces the release of stress hormones like cortisol. Furthermore, yoga increases the production of neurotransmitters like serotonin and GABA, which play a role in mood regulation, and stimulates the release of endorphins, which have analgesic and calming effects (Alizadeh Pahlavani, 2024; Stephens, 2017). Thus, mothers who practice maternity yoga are better able to control their emotions, feel relaxed, and experience reduced anxiety.

Meanwhile, birthing balls provide physiological effects through biomechanical and hormonal mechanisms (Grenvik et al., 2022)(Phalswal et al., 2024). The rhythmic movements of the ball stimulate proprioceptors and mechanoreceptors, thus creating a sensory distraction effect that is in accordance with gate control theory, where non-painful stimuli close the transmission pathways of pain impulses while reducing psychological tension. This movement also increases the release of oxytocin which is associated with feelings of comfort, emotional control, and pelvic muscle relaxation. In addition, the use of birthing balls provides a sense of control over the body, so that the mother feels more confident and is able to face contractions calmly (Phalswal et al., 2024). The combination of these two interventions produces a synergistic effect in the form of a significant reduction in anxiety levels, which in turn supports the smooth physiological course of labor.

The effect of the combination of birthing ball and birthing yoga on the duration of labor

The difference in distribution between the two groups indicates a positive effect of the intervention on accelerating labor. The proportion of respondents with rapid labor progress was higher in the intervention group (92.0%) than in the control group (76.0%). This indicates that the intervention helped respondents achieve an efficient labor process, likely through physiological mechanisms such as increased muscle relaxation,

optimized uterine contractions, and reduced psychological barriers caused by pain and anxiety.

The results of this study indicate that the combination of birthing ball and birthing yoga did not significantly affect labor duration between the intervention and control groups ($p = 0.127$), although descriptively, the intervention group had a lower average duration rating. This finding indicates a tendency for labor to accelerate in the intervention group, but statistical power was insufficient to confirm a significant difference. One possible reason is the relatively small sample size, which prevented a significant effect from being detected. Furthermore, parity is also a factor: primiparous mothers tend to experience greater benefits than multiparous or grandemultiparous mothers.

The results of the study in the intervention group showed that the duration of labor in mothers who were given birthing balls and birthing yoga tended to be shorter than in the control group. This is in line with research conducted by Terres et al. (2025), a meta-analysis of 10 RCTs in low-risk parturients found that the use of birth balls reduced the duration of the first stage of labor by more than two hours compared to the control group (MD±130.12 minutes) with statistical significance, while in the study conducted by Lisa et.al (2022) it was stated that a meta-analysis of 31 studies (2217 pregnant women) showed that prenatal yoga interventions significantly reduced the duration of labor (mean difference± 117.75 minutes) compared to control, and had a positive effect on reducing anxiety and labor pain (Delgado et al., 2019; Terres et al., 2025).

Physiologically, the combination of birthing yoga and a birthing ball works through two complementary pathways. Pelvic movements with the ball improve fetal positioning, loosen pelvic floor muscles, and facilitate cervical dilation, while birthing yoga reduces anxiety through parasympathetic activation, decreased cortisol, and increased oxytocin, which supports more effective contractions (Delgado et al., 2019; Kuder et al., 2025). Previous studies in the past five years have generally reported that both birthing balls and birthing yoga, individually, can shorten the active phase and total duration of labor (Corrigan et al., 2022). Therefore, although this study did not find a significant difference, this combined intervention remains promising as a complementary strategy to facilitate labor and has the potential to demonstrate stronger results with a larger sample size and more consistent implementation.

The effect of the combination of birthing ball and birthing yoga on birth outcomes

The results showed that the combination of birthing ball and birthing yoga had a limited effect on labor pain. Paired t-test analysis showed an increase in pain scores from pretest to posttest in both groups, consistent with the progressive physiology of labor. However, the average posttest score in the intervention group was lower than the control group (7.60 vs. 8.52), although the intergroup t-test showed no significant difference ($p = 0.072$). This indicates that the intervention was able to slow pain escalation, although not statistically strong enough. These findings are consistent with the gate control theory, which explains that sensory stimulation through birthing ball movements can reduce pain transmission, as well as the support of birthing yoga, which helps with relaxation and emotional control.

In contrast, this combination of interventions proved highly effective in reducing maternal anxiety levels during labor. Analysis showed a significant decrease in anxiety scores in the intervention group (from 34.80 to 16.20; $p < 0.01$), while there was no significant change in the control group (from 26.64 to 26.00; $p = 0.754$). A posttest t-test showed a significant difference between groups ($p < 0.01$), with significantly lower anxiety scores in the intervention group. These results support the role of birth yoga in stimulating the parasympathetic nervous system, suppressing stress hormones, and increasing oxytocin, which promotes relaxation and calm. The birthing ball also provides a sense of control over the body, so the combination of the two produces a synergistic effect in reducing anxiety.

Regarding labor duration, the Mann–Whitney test showed that the intervention group had a lower mean duration rating (23.50) than the control group (27.50). Although this difference was not significant ($p = 0.127$), descriptively, there was a tendency for labor to accelerate in the intervention group. The physiological mechanisms underlying this include increased contraction effectiveness due to oxytocin stimulation, pelvic floor muscle relaxation, and reduced psychological barriers due to decreased anxiety. These findings are consistent with the literature reporting that non-pharmacological interventions often show beneficial clinical effects, although not always statistically significant due to individual variation and limited sample size.

Integratively, the combination of a birthing ball and birthing yoga can be viewed as a non-pharmacological intervention that affects two important aspects of labor: physiological and psychological. The birthing ball provides biomechanical support by helping to relax the pelvic floor muscles, improving fetal position, and facilitating more effective uterine contractions (Joseph et al., 2024; Sahara et al., 2022). Meanwhile, birthing yoga focuses on mental control through breathing and relaxation exercises, which suppress sympathetic activity and increase the release of oxytocin and endorphins (Abera et al., 2024). This combined intervention works synergistically to create a balance between body and mind, enabling mothers to better navigate labor with calm, comfort, and efficiency.

The results of this study indicate that the combination of birthing ball and birthing yoga has distinct effects on labor outcomes. The greatest effect was seen in the psychological aspect, with a significant reduction in

anxiety, while the effects on labor pain and duration were more clinical-descriptive and without statistical significance. Current literature supports this mechanism by showing that prenatal yoga consistently reduces anxiety, while the use of a birthing ball contributes to the acceleration of the active phase of labor and increases maternal comfort. However, the variation in results between studies also confirms that the effectiveness of interventions is influenced by many factors, including parity, intervention intensity, labor stage, and maternal obstetrical condition. Therefore, although the combination of yoga and birthing ball is more prominent in its impact on psychological aspects, such as reducing anxiety, the clinical benefits, such as a trend toward reduced pain and a shorter labor duration, remain important to note. Furthermore, the trend toward reduced pain and a shorter duration still demonstrates practical benefits, particularly for primiparous mothers who tend to be more susceptible to labor anxiety and pain.

CONCLUSIONS

Based on the results of the research conducted, it can be concluded that: 1) the combination of birthing ball and birthing yoga showed changes in the scale of labor pain in the intervention and control groups, but was not statistically tested for its effectiveness in reducing labor pain, 2) the combination of birthing ball and birthing yoga showed changes in the level of anxiety in the intervention group and obtained significant statistical test results, so that birthing ball and birthing yoga therapy is one of the non-pharmacological measures that can optimize labor outcomes, 3) the combination of birthing ball and birthing yoga showed differences in labor duration between the intervention and control groups, but has not yet statistically described the level of effectiveness and 4) the combination of birthing ball and birthing yoga has been proven to provide significant benefits in reducing maternal anxiety, while its effect on labor pain and duration is more visible as a clinical tendency even though it is not yet statistically significant.

In midwifery practice, the combination of birthing balls and birthing yoga can be recommended as a safe, affordable, and easy-to-implement non-pharmacological strategy. Midwives can integrate simple yoga exercises into antenatal classes and provide birthing balls in the delivery room to increase maternal comfort and security. This intervention is particularly relevant for primiparas, who generally face higher anxiety and longer labors than multiparas. Furthermore, this intervention has the potential to improve the quality of the birth experience, reduce the need for analgesics or medical interventions, and support more holistic maternal care. To strengthen the scientific evidence, further research with RCT designs, larger sample sizes, and subgroup analyses by parity is highly recommended.

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REFERENCES

Abera, M., Hanlon, C., Daniel, B., Tesfaye, M., Workicho, A., Girma, T., Wibaek, R., Andersen, G. S., Fewtrell, M., Filteau, S., & Wells, J. C. K. (2024). Effects of relaxation interventions during pregnancy on maternal mental health, and pregnancy and newborn outcomes: A systematic review and meta-analysis. *PloS One*, *19*(1), e0278432. https://doi.org/10.1371/journal.pone.0278432

Ahmadpour, P., Faroughi, F., & Mirghafourvand, M. (2023). The relationship of childbirth experience with postpartum depression and anxiety: A cross-sectional study. *BMC Psychology*, *11*(1), 1–9. https://doi.org/10.1186/s40359-023-01105-6

Alizadeh Pahlavani, H. (2024). Possible role of exercise therapy on depression: Effector neurotransmitters as key players. *Behavioural Brain Research*, *459*, 114791. https://doi.org/10.1016/j.bbr.2023.114791

Aslantaş, B. N., & Çankaya, S. (2024). The effect of birth ball exercise on labor pain, delivery duration, birth comfort, and birth satisfaction: A randomized controlled study. *Archives of Gynecology and Obstetrics*, *309*(6), 2459–2474. https://doi.org/10.1007/s00404-023-07115-4

Corrigan, L., Moran, P., McGrath, N., Eustace-Cook, J., & Daly, D. (2022). The characteristics and effectiveness of pregnancy yoga interventions: A systematic review and meta-analysis. *BMC Pregnancy and Childbirth*, *22*(1), 250. https://doi.org/10.1186/s12884-022-04474-9

Crowther, S., & Hall, J. (2015). Spirituality and spiritual care in and around childbirth. *Women and Birth*, *28*(2), 173–178. https://doi.org/10.1016/j.wombi.2015.01.001

Delgado, A., Maia, T., Melo, R. S., & Lemos, A. (2019). Birth ball use for women in labor: A systematic review and meta-analysis. *Complementary Therapies in Clinical Practice*, *35*, 92–101. https://doi.org/10.1016/j.ctcp.2019.01.015

Grenvik, J. M., Rosenthal, E., Wey, S., Saccone, G., De Vivo, V., De Prisco Lcp, A., Delgado García, B. E., & Berghella, V. (2022). Birthing ball for reducing labor pain: A systematic review and meta-analysis of randomized controlled trials. *The Journal of Maternal-Fetal & Neonatal Medicine: The Official Journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians*, *35*(25), 5184–5193. https://doi.org/10.1080/14767058.2021.1875439

Issac, A., Nayak, S. G., Priyadarshini, T., Balakrishnan, D., Halemani, K., Mishra, P., Indumathi, P., Vijay, V. R., Jacob,

J., & Stephen, S. (2023). Effectiveness of breathing exercise on the duration of labour: A systematic review and meta-analysis. *Journal of Global Health*, *13*. https://doi.org/10.7189/jogh.13.04023

Jeelani, M. S., & Habeeb, S. (2018). A Study To Assess the Effectiveness of Back Massage on Pain Among Primigravida Mothers During First Stage of Labour. *Ijresm.Com*, *8*(3).

Jha, S., Vyas, H., Nebhinani, M., Singh, P., & T, D. (2023). The Effect of Birthing Ball Exercises on Labor Pain and Labor Outcome Among Primigraviade Parturient Mothers at a Tertiary Care Hospital. *Cureus*, *15*(3), e36088. https://doi.org/10.7759/cureus.36088

Joseph, M. L., Batra, B. S., & Selvan, A. (2024). Comparative Study on Labor Pain Management: Birthing Ball vs. Traditional Methods-A Review. *African Journal of Biomedical Research*, *27*(4), 4372–4386. https://doi.org/10.53555/ajbr.v27i4s.4414

Kamal Abd Elkhalek, N., Ebrahim Ahmed, S., Mohamed Mohamed lotfy, I., & A. Shahin, M. (2021). Natural Methods for Relieving Labor Pain and Anxiety during the First Stage among Primigravida Mothers. *Egyptian Journal of Health Care*, *12*(3), 396–407. https://doi.org/10.21608/ejhc.2021.190768

Katili, D. N. O., Djunaid, U., Melani, N. A. D., Yunus, Y., & Harisa, K. (2023). Pengaruh Teknik Massage Endorphin Dan Teknik Relaksasi Nafas Dalam Terhadap Nyeri Persalinan. *Health Information: Jurnal Penelitian*, *15*(2), 1–7.

Katili, D. N. O., Hiola, F. A. A., Melani, N. A. D., Yunus, Y., & Wulandari, N. (2023). Studi Literatur: Pengaruh Yoga Bersalin terhadap Kemajuan Persalinan Ibu Inpartu Kala I Fase Aktif. *Jurnal Kolaboratif Sains*, *6*(7), 915–922.

Katili, D. N. O., Umar, S., & Gres, A. M. (2019). Pengaruh Telur Ayam Rebus Terhadap Peningkatan Kadar Hb Ibu Hamil Trimester I di Wilayah Kerja Puskesmas Tilango. *Madu Jurnal Kesehatan*, *8*(1), 9–22. https://doi.org/10.31314/mjk.8.1.9-22.2020

Katili, D. N. O., Usman, S., & Potale, K. (2021). Pengaruh Akupresur terhadap Penurunan Nyeri Persalinan Kala I Fase Aktif. *Madu Jurnal Kesehatan*, *7*(1).

Kementerian Kesehatan Republik Indonesia. (2023). Laporan Survei Kesehatan Indonesia (SKI) 2023. In *Badan Kebijakan Pembangunan Kesehatan (BKPK) Kemenkes RI*. Badan Kebijakan Pembangunan Kesehatan (BKPK) Kemenkes RI.

Kuder, L., Dinevski, D., Dinevski, I. V., Takač, I., Mujezinović, F., & Elvedi Gašparović, V. (2025). Benefits of yoga in pregnancy: A randomised controlled clinical trial. *Journal of Perinatal Medicine*, *53*(3), 350–357. https://doi.org/10.1515/jpm-2024-0422

Nahaee, J., Rezaie, M., Abdoli, E., Mirghafourvand, M., Ghanbari-Homaie, S., & Jafarzadeh, M. (2024). Association of childbirth experience with long–term psychological outcomes: A prospective cohort study. *Reproductive Health*, *21*(1), 1–9. https://doi.org/10.1186/s12978-024-01819-9

Ning, S., Ahmad, M., Nontji, W., Yuliana, S., Andi, Nilawati, U., & Arsyad, M. A. (2024). KOMBINASI PRENATAL YOGA DENGAN BIRTH BALL EFEKTIF Combination of Prenatal Yoga with Birth ball is Effective on the Duration of. *MEDIA PENELITIAN DAN PENGEMBANGAN KESEHATAN*, *34*(4).

Nisha, A., Shamim, A., Rizvi, A., Mahmood, T., Goswami, B., Ahsan, F., Sharique, M., & Parveen, S. (2025). A Comprehensive Review of Experimental Models of Stress: Pragmatic Insight Into Psychoneuroimmunology. *Health Care Science*, *4*(1), 4–13. https://doi.org/10.1002/hcs2.70002

Nori, W., Kassim, M. A. K., Helmi, Z. R., Pantazi, A. C., Brezeanu, D., Brezeanu, A. M., Penciu, R. C., & Serbanescu, L. (2023). Non-Pharmacological Pain Management in Labor: A Systematic Review. *Journal of Clinical Medicine*, *12*(23). https://doi.org/10.3390/jcm12237203

Phalswal, U., Jha, S., Dixit, P., & Yadav, R. (2024). Effectiveness of Birthing Ball Exercises Therapy in Improving Labor Pain and Labor Outcomes: A Systematic Review. *Journal of Family and Reproductive Health*, *18*(4), 208–216. https://doi.org/10.18502/jfrh.v18i4.17409

Rantala, A., Hakala, M., & Pölkki, T. (2022). Women's perceptions of the pain assessment and non-pharmacological pain relief methods used during labor: A cross-sectional survey. *European Journal of Midwifery*, *6*(April), 1–10. https://doi.org/10.18332/ejm/146136

Sahara, R., Dahlan, F. M., & Suralaga, C. (2022). Science Midwifery The Effect Of The Use Of Birth Ball On Intensity Of Labor Pain I Active Phase In Primigravidal Mothers In Pmb Bekasi City In 2022. *Science Midwifery*, *10*(3), 2721–9453.

Stephens, I. (2017). Medical yoga therapy. *Children*, *4*(2), 1–20. https://doi.org/10.3390/children4020012

Tabuk, S., & Banjar, K. (2023). Penerapan Birthing Ball pada Ibu Bersalin. *Pengabdian Kepada Masyarakat*, *2*(02), 349–365.

Terres, M. T., de Carvalho Souza, M. V., Costa, L. M. O., Novaes, L., de Avila, M. F., Barros, S. G., Provinciatto, H., & Piovezan, A. P. (2025). Efficacy of birthing ball exercises to reduce labor pain and cesarean rates: An updated meta-analysis of randomized controlled trials. *Archives of Gynecology and Obstetrics*, *311*(5), 1331–1341. https://doi.org/10.1007/s00404-024-07930-3

Villar-Alises, O., Martinez-Miranda, P., & Martinez-Calderon, J. (2023). Prenatal Yoga-Based Interventions May Improve Mental Health during Pregnancy: An Overview of Systematic Reviews with Meta-Analysis. *International Journal of Environmental Research and Public Health*, *20*(2). https://doi.org/10.3390/ijerph20021556

Wadhwa, Y., Alghadir, A. H., & Iqbal, Z. A. (2020). Effect of Antenatal Exercises, Including Yoga, on the Course of Labor, Delivery and Pregnancy: A Retrospective Study. *International Journal of Environmental Research and Public Health*, *17*(15). https://doi.org/10.3390/ijerph17155274

Walter, M. H., Abele, H., & Plappert, C. F. (2021). The Role of Oxytocin and the Effect of Stress During Childbirth: Neurobiological Basics and Implications for Mother and Child. *Frontiers in Endocrinology*, *12*(October), 1–10. https://doi.org/10.3389/fendo.2021.742236

Watson, K., White, C., Hall, H., & Hewitt, A. (2021). Women's experiences of birth trauma: A scoping review. *Women and Birth*, *34*(5), 417–424. https://doi.org/10.1016/j.wombi.2020.09.016

Williams, Heidi J, Broomé, Rodger E, & Markette, Nicholas. (2023). Fathers' Lived-Experience of Childbirth: A Descriptive Phenomenological Psychological Inquiry. *Journal of Humanistic Psychology*, 00221678231194096. https://doi.org/10.1177/00221678231194096

Yekefallah, L., Namdar, P., Dehghankar, L., Golestaneh, F., Taheri, S., & Mohammadkhaniha, F. (2021). The effect of yoga on the delivery and neonatal outcomes in nulliparous pregnant women in Iran: A clinical trial study. *BMC Pregnancy and Childbirth*, *21*(1), 351. https://doi.org/10.1186/s12884-021-03794-6

Yeun, Y.-R., & Kim, S.-D. (2021). Effects of yoga on immune function: A systematic review of randomized controlled trials. *Complementary Therapies in Clinical Practice*, *44*, 101446. https://doi.org/10.1016/j.ctcp.2021.101446

Zuarez-Easton, S., Erez, O., Zafran, N., Carmeli, J., Garmi, G., & Salim, R. (2023). Pharmacologic and nonpharmacologic options for pain relief during labor: An expert review. *American Journal of Obstetrics and Gynecology*, *228*(5S), S1246–S1259. https://doi.org/10.1016/j.ajog.2023.03.003

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