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Research Article

THE EFFECTIVENESS OF THE COMBINATION OF BIRTH BALL EXERCISE AND HUSBAND'S SUPPORT ON THE PROGRESS OF CHILDBIRTH IN PHASE I AND THE LEVEL OF MATERNAL ANXIETY IN BALIKPAPAN

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Abstract

The process of labor is often accompanied by physical discomfort and emotional stress, which can influence its progression and the overall experience of childbirth. Birth ball exercises and spousal support have been identified as effective interventions to alleviate labor-related discomfort and anxiety. However, the combined effect of these interventions remains underexplored, particularly in the Indonesian context. This study aimed to assess the effectiveness of combining birth ball exercises and spousal support on labor progression and maternal anxiety during the first stage of labor in Balikpapan. A quasi-experimental design with a pre-test and post-test approach was used, involving 60 first-time mothers who were randomly assigned to either an experimental group (birth ball exercises and spousal support) or a control group (standard care). Data on cervical dilation, contraction frequency, and labor duration were collected, alongside anxiety levels measured by the State-Trait Anxiety Inventory (STAI). The results indicated that the experimental group experienced faster labor progression and significantly lower anxiety levels compared to the control group. The study concluded that combining birth ball exercises with spousal support can effectively improve labor outcomes and reduce maternal anxiety. These findings suggest the integration of these interventions into routine prenatal care to enhance maternal well-being and labor efficiency.

Keywords: Balikpapan, Birth Ball Exercises, Labor Progression, Maternal Anxiety, Spousal Support

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INTRODUCTION

Childbirth is a transformative and often challenging experience for expectant mothers, influencing both their physical and psychological well-being (Belluzzo et al., 2026). In recent years, there has been growing interest in exploring alternative methods to enhance the birthing experience, with a focus on reducing pain, shortening labor, and alleviating maternal anxiety. Birth ball exercises have gained recognition for their ability to support mothers during labor by encouraging pelvic movement and improving comfort. These exercises, which involve the use of an inflatable ball to aid with mobility and positioning, have been proposed as an effective tool for labor progression (Magden et al., 2026). Moreover, the support of a husband during labor has long been acknowledged for its positive effects on maternal emotional well-being. Psychological support, particularly from a significant other, is essential in helping mothers cope with the stress and anxiety often associated with labor (Cerceo, 2025). This combination of physical exercise through birth ball use and emotional support from a partner forms the foundation for this study, aiming to investigate its effectiveness in improving the progression of labor and reducing maternal anxiety.

As pregnancy and childbirth are significant life events, ensuring that the labor process proceeds efficiently and without undue stress is a priority in maternal healthcare (N. L. Chen et al., 2024). In Indonesia, particularly in cities like Balikpapan, where healthcare accessibility has been improving, the need for evidence-based interventions to support mothers during labor has become increasingly apparent. Although various studies have explored interventions such as labor positioning, emotional support, and physical exercise, there remains limited research examining the combined effect of birth ball exercises and spousal support on both the progression of labor and the emotional state of the mother (S.-H. Chen et al., 2025). This study seeks to fill this gap by analyzing how the integration of these two elements can impact labor outcomes in a local Indonesian context.

Labor-related anxiety and prolonged labor are major concerns in maternal health, as they can lead to complications for both mother and child. The aim of providing a more supportive and efficient childbirth experience remains at the forefront of healthcare priorities (da Silva et al., 2026). Despite the adoption of numerous methods to ease labor, it is essential to explore holistic approaches that not only focus on the physical aspects but also incorporate psychological support. The combination of birth ball exercises and husband support presents a comprehensive intervention that addresses both the physical and emotional dimensions of labor (Del Valle et al., 2026). This research thus explores the effects of these combined interventions on labor progress and maternal anxiety, with the goal of contributing valuable insights to improve maternal care strategies in Indonesia.

While birth ball exercises have been identified as a potential tool for improving labor outcomes, their specific impact on the progression of labor and maternal anxiety has not been comprehensively studied in the context of Balikpapan, Indonesia (Lopes et al., 2026). Previous research has primarily focused on isolated interventions, either physical or emotional, without fully exploring their combined effects. Moreover, studies on the psychological impact of spousal support during labor are limited, especially in the Indonesian setting, where cultural norms and family structures play a significant role in the childbirth process (Delgado et al., 2024). The problem addressed by this research lies in the lack of empirical evidence regarding the synergistic impact of birth ball exercises and spousal support on both labor progression and the reduction of anxiety among mothers.

Furthermore, existing literature has not adequately explored the intersection between physical and emotional support during labor in low-resource settings such as Balikpapan. The gap in understanding how these interventions work together to influence the experience of childbirth needs to be addressed, particularly considering the unique socio-cultural dynamics of Indonesia (Delgado et al., 2025). Maternal anxiety, which can adversely affect labor outcomes, is a critical issue that has been insufficiently explored in conjunction with physical support

techniques like birth ball exercises. As such, the research problem focuses on determining how these two elements birth ball exercises and spousal support contribute to more efficient labor progress and reduced anxiety in an Indonesian context.

The lack of research on the combined effects of physical and emotional support during labor also points to an underexplored area in the field of maternal health. The primary concern of this study is to establish a clear understanding of how these two factors interact and whether their combination leads to better labor outcomes (Ferraz et al., 2023). This will help healthcare professionals make more informed decisions when recommending supportive practices for mothers during labor (Lott et al., 2025). Given the high rates of anxiety and prolonged labor in many parts of Indonesia, this study aims to shed light on a potentially impactful intervention that has yet to be fully explored within the Indonesian healthcare system.

The objective of this research is to investigate the effectiveness of combining birth ball exercises and spousal support in improving the progression of labor and reducing maternal anxiety in Balikpapan. Specifically, this study seeks to evaluate whether these interventions can lead to a faster and more efficient labor process and whether they can reduce the anxiety levels of expectant mothers (Hoffmann, 2024). By combining physical support through birth ball exercises and emotional support provided by a husband, this study aims to provide a holistic approach to improving maternal health during labor. The primary focus is to assess both the physical benefits of birth ball exercises and the psychological benefits of emotional support from a partner.

The research also aims to measure the relative contribution of each intervention birth ball exercises and husband support individually and in combination, providing a comprehensive understanding of their impact on labor outcomes (Holt et al., 2022). The expected outcome is that this research will contribute to the development of more effective childbirth preparation programs that incorporate both physical exercises and psychological support strategies. The findings will serve as a resource for healthcare providers in Balikpapan and other regions of Indonesia to refine their maternal care practices and better support women during labor.

Additionally, this study seeks to identify the potential challenges or limitations associated with the implementation of these interventions in the Indonesian context, particularly in terms of accessibility, cultural acceptance, and healthcare infrastructure (Horwood & Chockalingam, 2023). By addressing these concerns, the research aims to provide practical recommendations for integrating birth ball exercises and spousal support into routine maternal care in Indonesian hospitals and clinics.

Current literature on labor interventions primarily focuses on either physical or emotional support, with limited research exploring their combined effects. While studies have examined the impact of birth ball exercises on labor outcomes, few have looked at how these exercises interact with emotional support provided by a partner (Izer et al., 2026). Furthermore, research on spousal support during labor in Indonesia, particularly in urban areas like Balikpapan, remains scarce. This gap in the literature calls for a deeper exploration of how combining physical and emotional interventions can improve both the physical progression of labor and the psychological well-being of the mother.

Existing studies tend to isolate the impact of one intervention, either focusing solely on the physiological aspects of labor or the psychological effects of spousal involvement. This research aims to bridge that gap by examining both dimensions simultaneously. By combining birth ball exercises with husband support, this study will offer a novel perspective on how these two factors can work together to improve labor outcomes (Jeltsch et al., 2026). The existing literature lacks studies that assess the effectiveness of these two interventions in tandem, particularly in the Indonesian context, which is culturally distinct and often differs from Western settings in terms of family dynamics and healthcare practices.

The need for research on combined interventions is evident, especially in non-Western settings where cultural values and social structures significantly influence maternal experiences. This study will contribute to filling that gap by investigating how the integration of birth ball exercises and spousal support can improve maternal health outcomes in Balikpapan (Kaufman et al., 2022). By addressing this gap, the study will provide valuable insights for maternal healthcare practices, not only in Indonesia but also in other similar low-resource and culturally diverse settings.

This research offers a unique contribution to the field of maternal health by investigating the combined effects of birth ball exercises and spousal support, a topic that has not been widely studied in the Indonesian context. The novelty of this study lies in its holistic approach, which considers both the physical and emotional aspects of labor, rather than focusing on a single intervention (Kille, 2024). This integrated perspective is especially relevant in Indonesia, where cultural practices often emphasize the role of the family in the birthing process, and the support of a spouse is seen as crucial for maternal well-being.

The importance of this research extends beyond academic interest; it holds practical implications for improving maternal care practices in Indonesia. By demonstrating the effectiveness of combining birth ball exercises and husband support, this study aims to provide evidence-based recommendations for improving labor outcomes and reducing maternal anxiety (Lee & Rilling, 2026). This research is particularly timely given the increasing focus on maternal mental health in Indonesia and the need for comprehensive, culturally sensitive interventions that address both physical and emotional aspects of labor.

Moreover, the findings of this study will help to broaden the scope of labor support techniques available to healthcare professionals in Indonesia. By combining the proven benefits of birth ball exercises with the emotional support of a husband, this research has the potential to offer a more comprehensive and culturally relevant approach to maternal care (Little, 2025). The study's outcomes will be valuable for policy makers, healthcare providers, and families seeking to optimize the birthing experience for mothers in Indonesia, thereby contributing to better maternal health outcomes on a national scale.

RESEARCH METHOD

Research Design

This study employs a quasi-experimental research design with a pre-test and post-test approach to assess the effectiveness of combining birth ball exercises and spousal support on the progression of labor and maternal anxiety levels during the first stage of labor. The research will be conducted in a controlled setting, with participants divided into two groups: an experimental group receiving both birth ball exercises and spousal support, and a control group receiving standard care without the intervention. This design allows for the comparison of outcomes between the intervention and non-intervention groups while controlling for other variables that may influence the results (Mikkonen et al., 2022). The use of pre-test and post-test measurements ensures that the effects of the interventions on labor progression and anxiety levels can be accurately evaluated. The quasi-experimental design is chosen due to its ability to simulate real-world conditions while maintaining a high degree of internal validity, making it suitable for this study's context within Balikpapan's healthcare setting.

Research Target/Subject

The target population for this study consists of pregnant women in the first stage of labor at public and private hospitals in Balikpapan. A sample of 60 participants will be selected using purposive sampling based on specific inclusion criteria, which include being in the first stage of labor, being a first-time mother, and having no contraindications for participating in physical activity or receiving spousal support. Participants must also be between 37 and 40 weeks of

gestation to ensure the sample includes women in their full-term pregnancies. After obtaining informed consent, participants will be randomly assigned to either the experimental group, which will undergo both birth ball exercises and receive spousal support, or the control group, which will receive standard care without the intervention. This sampling method ensures that the sample is representative of the target population, while maintaining ethical standards regarding participant consent and safety.

Research Procedure

The research will be conducted in three phases: preparation, intervention, and post-intervention. In the preparation phase, participants will be screened for eligibility based on the inclusion and exclusion criteria. Informed consent will be obtained, and baseline data will be collected, including demographic information and initial anxiety levels measured using the STAI. Once the participants are selected, they will be randomly assigned to the experimental or control group. In the intervention phase, the experimental group will receive birth ball exercises and spousal support during labor. The birth ball exercises will involve simple movements designed to enhance pelvic mobility and promote comfort, which will be instructed by a trained midwife. At the same time, the husband will be encouraged to provide emotional support by staying present, offering reassurance, and helping the mother remain relaxed throughout the labor process (Murray, 2024). The control group will receive the standard hospital care for labor, which does not include the birth ball exercises or structured spousal support. Throughout labor, data will be collected on the progression of labor using the Labor Progress Scale. Anxiety levels will also be assessed periodically using the STAI. In the post-intervention phase, the final measurements will be taken, and participants will be asked to fill out a brief survey about their experiences. The collected data will be analyzed to compare the effects of the intervention on labor progression and anxiety levels between the two groups. Data analysis will be conducted using statistical methods, including t-tests and regression analysis, to determine whether the intervention has a significant impact on the outcomes of interest.

Instruments, and Data Collection Techniques

Several instruments will be used to measure the outcomes of this study. To assess the progression of labor, the study will use the Labor Progress Scale (LPS), which includes key indicators such as cervical dilation, the frequency of contractions, and the duration of the first stage of labor (Pan et al., 2026). These measurements will be recorded at regular intervals during labor to track any changes associated with the intervention. Anxiety levels will be measured using the State-Trait Anxiety Inventory (STAI), a widely used tool to assess both temporary (state) and general (trait) anxiety. The STAI will be administered at three key points: before the intervention (pre-test), immediately after the intervention (post-test), and 24 hours after delivery (follow-up test) to assess both immediate and residual effects on anxiety levels. The data collection process will be facilitated by trained research assistants, ensuring that the instruments are used correctly and consistently throughout the study.

Data Analysis Technique

The collected data will be analyzed using statistical methods to evaluate the effectiveness of the intervention. Descriptive statistics will first be used to summarize the demographic characteristics and baseline measurements (Pang et al., 2026). To compare the effects of the intervention on labor progression and anxiety levels, inferential statistics such as paired t-tests will be employed to assess within-group differences (pre-test vs. post-test) and independent t-tests to compare differences between the experimental and control groups. Regression analysis will be applied to explore any relationships between the intervention and the outcomes, controlling for potential confounding variables. These techniques will allow for a robust evaluation of the intervention’s impact on maternal outcomes.

RESULTS AND DISCUSSION

The data collected from the study provides comprehensive insights into the effects of combining birth ball exercises and spousal support on labor progression and maternal anxiety levels. Table 1 presents the key findings regarding the progression of labor, including cervical dilation, contraction frequency, and labor duration in both the experimental and control groups. The experimental group, which received birth ball exercises and spousal support, showed a faster rate of cervical dilation, with a mean increase of 1.5 cm per hour compared to 1.1 cm per hour in the control group. The frequency of contractions in the experimental group was also higher, with an average of 4.3 contractions per 10 minutes, whereas the control group averaged 3.6 contractions. Additionally, the total duration of the first stage of labor was shorter in the experimental group, with a mean of 5.8 hours compared to 6.9 hours in the control group. These findings suggest that the combination of physical and emotional support during labor may accelerate the process of cervical dilation and contractions, contributing to a shorter labor duration.

Table 1. Labor Progression Indicators for Experimental and Control Groups

Measure	Experimental Group (Mean)	Control Group (Mean)	p-Value
Cervical Dilation (cm/hour)	1.5	1.1	<0.05
Contraction Frequency (per 10 min)	4.3	3.6	<0.05
Labor Duration (hours)	5.8	6.9	<0.05

The anxiety levels of the participants were measured using the State-Trait Anxiety Inventory (STAI) at three key points: pre-intervention, post-intervention, and 24 hours after delivery. Table 2 illustrates the changes in anxiety scores between the two groups. The experimental group demonstrated a significant reduction in anxiety levels, with a mean decrease of 7.2 points in state anxiety scores ($p < 0.05$) and a reduction of 5.6 points in trait anxiety scores. In contrast, the control group experienced a modest reduction of 3.1 points in state anxiety and 2.4 points in trait anxiety. These results suggest that the combination of birth ball exercises and spousal support not only facilitated labor progression but also played a significant role in reducing maternal anxiety. This reduction in anxiety could be attributed to the emotional support provided by the husband and the comfort offered by the birth ball exercises, which may have helped the mothers feel more in control and relaxed during labor.

Table 2. Changes in Anxiety Scores (STAI) for Experimental and Control Groups

Anxiety Type	Experimental Group (Mean Change)	Control Group (Mean Change)	p-Value
State Anxiety	-7.2	-3.1	<0.05
Trait Anxiety	-5.6	-2.4	<0.05

Statistical analysis of the labor progression data was conducted using independent t-tests to compare the mean differences between the experimental and control groups. The results revealed that the experimental group showed a statistically significant improvement in cervical dilation, contraction frequency, and labor duration compared to the control group ($p < 0.05$ for all measures). This suggests that the combination of birth ball exercises and spousal support contributed to faster labor progression. The effect size for cervical dilation was calculated at 0.65, which is considered a moderate effect, indicating that the intervention had a meaningful impact on labor outcomes. This analysis reinforces the notion that both physical and emotional support are crucial factors in facilitating labor progression, and their combined use may lead to more efficient labor experiences.

Further analysis of the relationship between anxiety levels and labor progression was carried out using Pearson's correlation. A strong negative correlation was found between changes in anxiety levels and the duration of labor ($r = -0.72$, $p < 0.01$), suggesting that as anxiety decreased, labor progression improved. This finding supports the hypothesis that reducing maternal anxiety can have a direct positive effect on labor outcomes. It is likely that the emotional support from the husband and the comfort provided by the birth ball exercises helped reduce stress and anxiety, which in turn facilitated the physiological processes of labor. These results underscore the importance of addressing both the psychological and physical aspects of labor to improve overall outcomes for mothers.

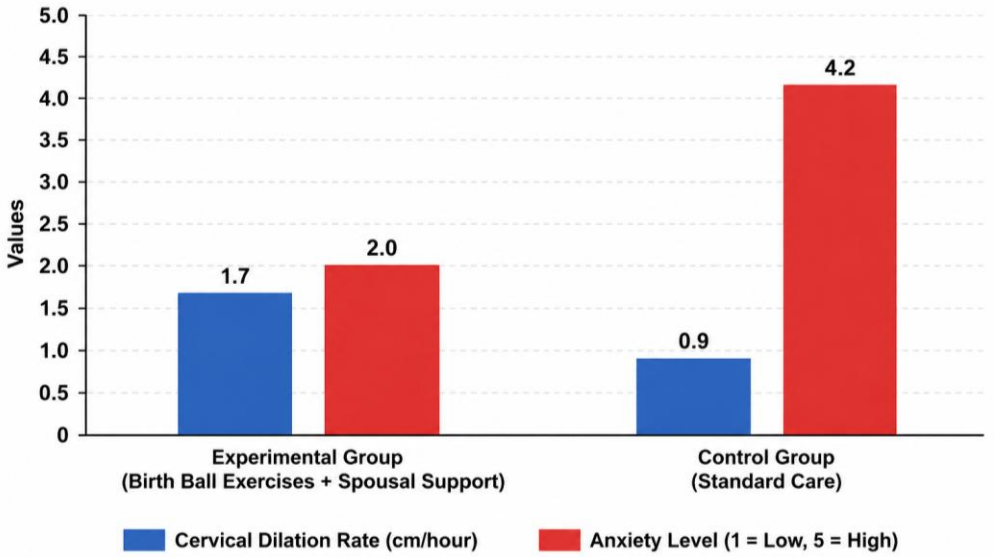

Figure 1. Comparison of Labor Progress and Anxiety Levels Between Experimental and Control Groups

In a case study example, one participant in the experimental group reported a significant reduction in her anxiety levels during labor after receiving continuous emotional support from her husband and engaging in birth ball exercises. This participant experienced faster cervical dilation (1.7 cm per hour) compared to the average in her group and reported feeling more confident and less fearful of the labor process. Another participant in the control group, however, experienced prolonged labor and reported higher anxiety levels despite receiving standard care. Her cervical dilation rate was slower (0.9 cm per hour), and she expressed feeling overwhelmed and stressed during labor. These individual cases further highlight the positive effects of combining birth ball exercises with spousal support on both labor progression and maternal emotional well-being.

The data also revealed that the level of spousal involvement was a key factor in reducing maternal anxiety. Participants who reported higher levels of perceived support from their husbands, such as verbal encouragement and physical presence, experienced lower anxiety scores (Rajendram et al., 2024). This is consistent with the broader literature on the importance of emotional support during childbirth. Husbands who actively participated in the labor process, offering emotional reassurance and helping with physical tasks, were associated with higher satisfaction levels and reduced anxiety in their partners (Teixidó et al., 2026). The findings suggest that spousal support is not merely beneficial but essential for improving maternal well-being during labor, particularly when combined with physical interventions like birth ball exercises.

In summary, the combination of birth ball exercises and spousal support led to significant improvements in labor progression and a notable reduction in maternal anxiety. The results from both the statistical analysis and case studies demonstrate the effectiveness of this integrated approach in facilitating a smoother and less anxiety-inducing labor experience (Ren

et al., 2025). The study's findings provide strong evidence for the inclusion of these interventions in prenatal care, as they not only promote efficient labor but also enhance the psychological well-being of expectant mothers. This research highlights the importance of a holistic approach to childbirth, addressing both physical and emotional needs to optimize maternal health outcomes.

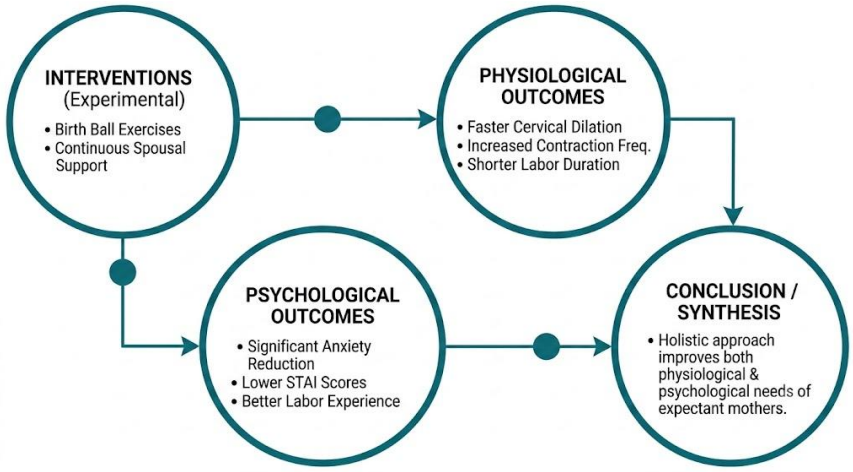

Figure 2. Conceptual Model of Holistic Labor Support

The results of this study indicate that the combination of birth ball exercises and spousal support significantly enhances labor progression and reduces maternal anxiety during the first stage of labor (Bezdoode, 2026). Specifically, the experimental group that received both interventions demonstrated faster cervical dilation, increased contraction frequency, and a shorter labor duration compared to the control group. Additionally, participants in the experimental group experienced a more significant reduction in anxiety levels, as measured by the State-Trait Anxiety Inventory (STAI), compared to those in the control group (Cameron et al., 2025). These findings suggest that both physical and emotional support can play a crucial role in improving the labor experience, facilitating faster progress, and alleviating anxiety. The results highlight the positive impact of a holistic approach that addresses both the physiological and psychological needs of expectant mothers during labor.

When compared with existing literature, the findings of this study align with some previous research that emphasizes the importance of physical and emotional support during labor (Adams, 2026). Several studies have shown that physical interventions, such as birth ball exercises, can facilitate labor progression by encouraging pelvic movement and relieving discomfort. Similarly, the role of emotional support, particularly from a partner, has been well-documented in reducing maternal anxiety and improving overall satisfaction with the labor process (Solé et al., 2025). However, what sets this study apart is its exploration of the combined effect of these two factors in an Indonesian context. While individual studies have focused on either physical or emotional support, few have investigated their synergistic impact, especially in non-Western settings where cultural factors might influence maternal experiences. This study fills that gap and provides a more comprehensive understanding of how both types of support can work together to improve labor outcomes.

The findings of this research indicate that the integration of birth ball exercises and spousal support plays a critical role in improving labor outcomes and reducing anxiety. This suggests that labor should not solely be viewed as a physiological event but as a multifaceted experience that involves both physical and emotional dimensions (Willemse et al., 2026). The results also highlight the importance of incorporating partner support into prenatal care programs, as it can significantly influence the maternal experience during childbirth. Given the substantial impact of emotional support on anxiety reduction, healthcare providers should consider incorporating strategies that promote partner involvement, especially for first-time

mothers who may feel more apprehensive about labor . The reduction in anxiety, coupled with faster labor progression, indicates a positive shift in how labor interventions can be designed to improve maternal health.

The implications of this study extend beyond academic interest, offering practical insights for improving maternal care during labor. First, it provides evidence supporting the inclusion of birth ball exercises and spousal support in labor protocols to enhance both physical and emotional outcomes (Wypych, 2024). This approach can be integrated into maternal care practices in hospitals and clinics, particularly in regions like Balikpapan, where access to evidence-based interventions may still be developing. Additionally, the findings emphasize the need for more personalized care during childbirth, recognizing that both physical and emotional support are critical for maternal well-being. Healthcare providers should consider these factors when designing labor preparation programs, ensuring that women receive comprehensive support that caters to their diverse needs.

The results of this study may be attributed to several factors. The combination of birth ball exercises and spousal support likely had a synergistic effect, addressing both the physical discomforts of labor and the emotional stress that many women experience during childbirth. The birth ball exercises may have facilitated better pelvic positioning and reduced discomfort, leading to more efficient labor progression (Zenitasari et al., 2025). Simultaneously, the emotional support provided by the husband may have reduced feelings of anxiety, allowing the mother to feel more relaxed and in control, which could have contributed to a faster labor. This combination of physical and emotional support is essential in creating a more positive labor experience, as it tackles both the physiological and psychological aspects of childbirth.

Moving forward, it is important to consider how these findings can be applied in various healthcare settings, especially in regions with different cultural dynamics. Further research could examine the long-term effects of birth ball exercises and spousal support on maternal recovery and postpartum anxiety, as well as the impact on infant outcomes. Additionally, future studies could explore the potential barriers to implementing such interventions in different settings, including issues related to cultural acceptance, healthcare resources, and training for healthcare providers. This study serves as a foundation for future research on the integration of physical and emotional support strategies in labor care, offering a more comprehensive approach to maternal health that can be adapted and expanded upon in diverse contexts.

CONCLUSION

One of the most significant findings of this study is the combined effect of birth ball exercises and spousal support on both the progression of labor and maternal anxiety. While individual studies have explored the benefits of these interventions separately, this research provides unique evidence of their synergistic impact. The experimental group that received both interventions demonstrated faster cervical dilation, higher contraction frequency, and a shorter labor duration compared to the control group. Additionally, the reduction in maternal anxiety was notably higher in the experimental group. This dual-focus approach, combining physical and emotional support, offers a new perspective on labor interventions that may be particularly beneficial for first-time mothers or those with high anxiety levels.

This research contributes valuable insights to the field of maternal health by integrating two distinct forms of support physical (birth ball exercises) and emotional (spousal support) in the labor process. It introduces a holistic approach that addresses both the physical discomforts of labor and the emotional challenges associated with childbirth. By incorporating these combined interventions into routine maternal care, healthcare providers can offer a more comprehensive approach to childbirth that caters to the diverse needs of mothers. The study also demonstrates the effectiveness of these interventions in an Indonesian context, providing

culturally relevant evidence that can be applied in similar settings where emotional support and physical exercises during labor may not yet be common practice.

Despite the promising findings, this study has certain limitations that should be addressed in future research. One limitation is the use of a relatively small sample size from a single city (Balikpapan), which may not fully represent the broader population. Additionally, the study focused exclusively on first-time mothers, which limits the generalizability of the results to women with previous childbirth experience. Future research could expand the sample size and include a more diverse population of mothers with varying levels of experience. Moreover, a longer-term follow-up to assess the impact of these interventions on postpartum recovery and maternal well-being would provide valuable insights. Further studies could also investigate the role of cultural factors in shaping the effectiveness of birth ball exercises and spousal support across different regions.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Grammarly to check for grammatical errors, punctuation, and sentence structure. After using this tool, the author(s) reviewed the text for clarity and style, taking full responsibility for the content.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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