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The Role of the Massage Method with Deep Breathing Relaxation in Reducing the Intensity of Labor Pain: A Randomized Clinical Trial at Mukomuko Regional General Hospital, Indonesia

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ABSTRACT

Labor pain is a significant concern for expectant mothers, often leading to anxiety and potential complications. Non-pharmacological interventions like massage and deep breathing relaxation (DBR) have gained attention as safe and effective pain management options. This randomized clinical trial aimed to investigate the efficacy of combining massage and DBR in reducing labor pain intensity at Mukomuko Regional General Hospital, Indonesia. A randomized controlled trial was conducted with 100 pregnant women experiencing labor pain. Participants were randomly assigned to either the intervention group (massage + DBR) or the control group (standard care). Pain intensity was assessed using the Visual Analog Scale (VAS) before and after the intervention. Data were analyzed using appropriate statistical tests. The intervention group demonstrated a significantly greater reduction in VAS scores compared to the control group ($p < 0.05$). Participants in the intervention group reported higher satisfaction with pain management and a more positive childbirth experience. In conclusion, the combination of massage and DBR is a safe and effective non-pharmacological intervention for reducing labor pain intensity. This approach can be easily integrated into standard care practices, offering a valuable tool for improving maternal comfort and well-being during childbirth.

1. Introduction

Childbirth, a transformative life event, is often accompanied by labor pain, a complex physiological and psychological experience that varies in intensity and duration among women. This pain, while a natural part of the birthing process, can be a significant source of distress and anxiety for expectant mothers. The intensity and perception of labor pain are influenced by a multitude of factors, including the strength and frequency of uterine contractions, cervical dilation, fetal position, individual pain thresholds, cultural beliefs, and emotional state. Unmanaged or excessive labor pain can lead to adverse maternal and neonatal outcomes, including prolonged labor, increased risk of cesarean section, postpartum depression, and impaired maternal-infant bonding. In the realm of obstetric care, effective pain management during labor is paramount to ensure a positive childbirth experience and optimal outcomes for both mother and baby. Traditionally, pharmacological interventions such as epidural analgesia have been widely used to alleviate labor pain. While these methods can be effective in reducing pain intensity, they are not without limitations. Pharmacological interventions may be associated with side effects, such as hypotension, nausea, vomiting, and fever. Additionally, they may not be accessible to all women due to cost constraints or individual preferences.[1-3]

In recent years, there has been a growing recognition of the importance of non-pharmacological pain management techniques in labor. These interventions offer a safe, cost-effective, and empowering alternative to pharmacological methods. Non-pharmacological approaches encompass a wide range of techniques, including massage therapy, deep breathing relaxation (DBR), hydrotherapy, aromatherapy, music therapy, and hypnosis. These methods aim to reduce pain perception, promote relaxation, and enhance maternal coping mechanisms during labor. Massage therapy, a time-honored practice with roots in ancient civilizations, has emerged as a promising non-pharmacological intervention for labor pain management. It involves the manipulation of soft tissues, such as muscles and tendons, to alleviate pain, reduce muscle tension, improve blood circulation, and promote relaxation. Various massage techniques, including effleurage (gentle stroking), petrissage (kneading), and friction (rubbing), have been employed during labor to address pain and discomfort. The physiological mechanisms underlying the analgesic effects of massage are multifaceted. Massage stimulates the release of endorphins, the body's natural painkillers, which can bind to opioid receptors in the brain and spinal cord, thereby reducing pain perception. Additionally, massage can activate the gate control theory of pain, which posits that non-painful stimuli, such as touch and pressure, can inhibit the transmission of pain signals to the brain. Furthermore, massage can promote relaxation by reducing muscle tension and anxiety, which can indirectly alleviate pain. Deep breathing relaxation (DBR), another widely used non-pharmacological technique, involves slow, deep breaths that engage the diaphragm and promote relaxation. DBR can be practiced independently or in conjunction with other relaxation techniques, such as guided imagery and progressive muscle relaxation. The physiological effects of DBR include decreased heart rate, blood pressure, and muscle tension, as well as increased oxygenation and reduced stress hormones. These physiological changes can contribute to pain reduction and improved maternal well-being during labor.[4-6]

The efficacy of massage and DBR in reducing labor pain has been supported by a growing body of evidence. Numerous studies have demonstrated the positive impact of these interventions on pain intensity, maternal satisfaction, and childbirth experience. A systematic review and meta-analysis concluded that massage therapy is effective in reducing pain and improving maternal outcomes during labor. Similarly, a randomized controlled trial found that DBR significantly reduced pain intensity and anxiety levels in women during the first stage of labor. While the individual effects of massage and DBR have been well-documented, there is limited research on the combined effect of these two interventions.[6,7] This randomized clinical trial aimed to address this gap by investigating the efficacy of combining massage and DBR in reducing labor pain intensity at Mukomuko Regional General Hospital, Indonesia. The study hypothesized that the combined intervention would be more effective than standard care in reducing pain intensity and improving maternal outcomes. The study setting, Mukomuko Regional General Hospital, is a public hospital located in Mukomuko, Indonesia. The hospital serves a diverse population of pregnant women from urban and rural areas, making it an ideal setting to evaluate the effectiveness of non-pharmacological pain management interventions in a real-world context. This research holds significant implications for clinical practice and maternal health. If the combined intervention of massage and DBR proves to be effective in reducing labor pain, it could be integrated into standard care practices, offering a safe, accessible, and empowering pain management option for women in labor. This could lead to improved maternal satisfaction, reduced anxiety, and potentially better neonatal outcomes. Furthermore, the study's findings could inform the development of evidence-based guidelines for non-pharmacological pain management in labor, contributing to the advancement of maternal care in Indonesia and beyond.

2. Methods

A randomized controlled trial (RCT) design was employed to investigate the effectiveness of the combined massage and deep breathing relaxation (DBR) intervention in reducing labor pain intensity. This design was chosen due to its ability to minimize bias and provide strong evidence for causal relationships. The study adhered to the consolidated standards of reporting trials (CONSORT) guidelines for transparent and comprehensive reporting of RCTs. The study was conducted at the Mukomuko Regional General Hospital, a tertiary care facility in Mukomuko, Indonesia. The hospital serves a diverse population of pregnant women from both urban and rural areas, making it an ideal setting to assess the generalizability of the intervention. Pregnant women who met the following inclusion criteria were eligible to participate: Singleton pregnancy at term (37-42 weeks gestation); Experiencing labor pain (defined as a score of 4 or higher on the visual analog scale [VAS]) and Willingness to provide informed consent. Exclusion criteria included: Multiple pregnancies; Pre-existing medical conditions (e.g., hypertension, diabetes) that could affect labor pain or response to the intervention; Contraindications to massage or DBR (e.g., skin conditions, respiratory problems) and Refusal to participate. A sample size calculation was performed to determine the number of participants needed to detect a clinically significant difference in pain intensity between the intervention and control groups. Based on previous studies and a power analysis, a sample size of 100 participants (50 per group) was deemed sufficient to achieve adequate statistical power. Eligible participants were randomly assigned to either the intervention group or the control group in a 1:1 ratio using a computer-generated randomization sequence. Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes. This method prevented researchers and participants from knowing the group assignment before enrollment, minimizing selection bias.

Participants in the intervention group received a combined massage and DBR intervention. The intervention consisted of two components: 1. Massage: A 30-minute massage session was administered by a trained and certified midwife. The massage focused on the back, shoulders, and legs, using a combination of effleurage (gentle stroking), petrissage (kneading), and friction (circular movements) techniques. The midwife adjusted the pressure and techniques based on the participant's preferences and comfort level. 2. Deep breathing relaxation (DBR): Following the massage, participants received a 30-minute DBR session. The midwife guided the participants through slow, deep breathing exercises, emphasizing relaxation and pain management. The DBR session included instructions on diaphragmatic breathing, visualization techniques, and positive affirmations. Participants in the control group received standard care as per the hospital's routine protocols for labor pain management. This typically included: Continuous fetal monitoring; Maternal vital signs monitoring; Pain assessment using the VAS; Administration of pain medication (if requested by the participant).

The primary outcome was the change in pain intensity from baseline (pre-intervention) to post-intervention, measured using the visual analog scale (VAS). The VAS is a validated and widely used tool for assessing pain intensity. Participants were asked to rate their pain on a 10-cm line, with 0 representing "no pain" and 10 representing "worst pain imaginable." Several secondary outcomes were assessed to evaluate the broader impact of the intervention: Maternal Satisfaction: Participants' satisfaction with pain management was assessed using a Likert scale questionnaire; Childbirth Experience: The quality of the childbirth experience was evaluated using the childbirth experience questionnaire (CEQ); Anxiety Levels: Anxiety levels were measured using the State-Trait Anxiety Inventory (STAI), a validated tool for assessing anxiety; Neonatal Outcomes: Neonatal outcomes, including Apgar scores at 1 and 5 minutes, birth weight, and any complications, were recorded from medical records. Data were collected at three time points: 1. Baseline: Before the intervention, participants' demographic information (age, parity, gestational age) and baseline pain intensity (VAS score) were recorded. 2. Post-Intervention: Immediately after the intervention (or standard care for the control group), pain intensity (VAS score) was reassessed. 3. Follow-Up: At 24 hours postpartum, maternal satisfaction, childbirth experience, and anxiety levels were assessed. Neonatal outcomes were obtained from medical records. Trained research assistants collected data using standardized questionnaires and medical record reviews. All data were entered into a secure database for analysis.

Data were analyzed using SPSS software (version 26). Descriptive statistics were used to summarize participant characteristics and outcome measures. The independent t-test was used to compare continuous variables between the intervention and control groups, while the chi-square test was used for categorical variables. Analysis of covariance (ANCOVA) was used to adjust for baseline pain scores and other potential confounders. The primary analysis was conducted on an intention-to-treat basis, including all randomized participants regardless of adherence to the intervention. Sensitivity analyses were performed to assess the robustness of the findings. The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines. All participants provided written informed consent before enrollment. Participation was voluntary, and participants were free to withdraw from the study at any time without affecting their care.

3. Results and Discussion

Table 1 presents the baseline characteristics of the participants in the intervention and control groups. The average age of participants in both groups was 28 years old, with no significant difference between the groups (p=0.82). The majority of participants in both groups were primigravida (60%), and there was no significant difference in the distribution of primigravida between the groups (p=1.00). The average gestational age was 39 weeks in both groups, with no significant difference between the groups (p=0.75). The average baseline pain score was 6.5 in the intervention group and 6.4 in the control group, with no significant difference between the groups (p=0.86). There were no significant differences in education level or employment status between the two groups (p=0.53 and p=0.91, respectively). Overall, the table shows that the two groups were similar in terms of their baseline characteristics, which is important for ensuring the validity of the study results.

Table 1. Participant characteristics.

Characteristic	Intervention Group (n=50)	Control Group (n=50)	p-value
Age (years), mean (SD)	28 (5.2)	27.8 (5.1)	0.82
Primigravida, n (%)	30 (60)	30 (60)	1.00
Gestational age (weeks), mean (SD)	39.2 (1.3)	39.1 (1.4)	0.75
Baseline pain score (VAS), mean (SD)	6.5 (1.8)	6.4 (1.7)	0.86
Education level, n (%)			0.53
< High school	10 (20)	12 (24)	
High school	25 (50)	23 (46)	
> High school	15 (30)	15 (30)	
Employment status, n (%)			0.91
Employed	35 (70)	34 (68)	
Unemployed	15 (30)	16 (32)	

SD = standard deviation, VAS = Visual Analog Scale.

Table 2 displays the changes in pain intensity, as measured by the Visual Analog Scale (VAS), before and after the intervention for both the intervention and control groups. The intervention group, which received massage and deep breathing relaxation (DBR), experienced a mean reduction in VAS score of 3.2, while the control group had a mean reduction of 1.8. This difference in pain reduction was statistically significant ($p < 0.05$), indicating that the combined massage and DBR intervention was more effective in reducing labor pain intensity than standard care.

Table 2. Pain intensity (VAS scores).

Group	Pre-intervention, Mean (SD)	Post-intervention, Mean (SD)	Mean reduction (SD)	p-value
Intervention	6.5 (1.8)	3.3 (1.5)	3.2 (1.1)	<0.05
Control	6.4 (1.7)	4.6 (1.6)	1.8 (1.0)	-

Table 3 presents the secondary outcomes of the study, comparing the intervention group (massage and deep breathing relaxation) with the control group (standard care). The results indicate that the intervention group reported significantly higher satisfaction with pain management (mean score of 4.2 vs. 3.5, $p < 0.05$) and had a more positive childbirth experience (mean CEQ score of 85.3 vs. 78.5, $p < 0.05$) compared to the control group. However, there were no significant differences in anxiety levels between the two groups ($p = 0.31$). Additionally, there were no significant differences in neonatal outcomes, including Apgar scores at 1 and 5 minutes and birth weight, between the intervention and control groups. These findings suggest that the massage and DBR intervention not only effectively reduced pain intensity but also improved maternal satisfaction and childbirth experience without negatively impacting neonatal outcomes.

Table 3. Secondary outcomes.

Outcome	Intervention Group (n=50)	Control Group (n=50)	p-value
Satisfaction with pain management (Likert scale 1-5), mean (SD)	4.2 (0.8)	3.5 (1.0)	<0.05
Childbirth experience (CEQ score 0-100), mean (SD)	85.3 (12.1)	78.5 (14.3)	<0.05
Anxiety levels (STAI score), mean (SD)	35.2 (8.5)	36.8 (9.2)	0.31
Neonatal outcomes			
Apgar score 1 minute, mean (SD)	8.9 (0.3)	8.8 (0.4)	0.22
Apgar score 5 minutes, mean (SD)	9.0 (0.2)	9.0 (0.2)	0.85
Birth weight (g), mean (SD)	3250 (450)	3200 (480)	0.56

SD = Standard Deviation, CEQ = Childbirth Experience Questionnaire, STAI = State-Trait Anxiety Inventory.

The observed reduction in labor pain intensity resulting from the combined massage and deep breathing relaxation (DBR) intervention can be attributed to the synergistic effects of these two complementary techniques. Each modality engages distinct physiological and psychological pathways, culminating in a multifaceted approach to pain management that surpasses the efficacy of either technique alone. Massage, a tactile stimulation technique, exerts its analgesic effects through multiple interconnected mechanisms, encompassing both neurophysiological and physiological pathways. At the neurophysiological level, massage serves as a potent activator of mechanoreceptors, specialized sensory receptors embedded within the skin, muscles, and connective tissues. These mechanoreceptors are finely tuned to respond to mechanical stimuli, such as pressure, vibration, and stretching, which are inherent to various massage techniques. Upon activation, mechanoreceptors initiate a cascade of neural signals that ascend through the spinal cord to the brain, where they are processed and interpreted. One of the key neural pathways involved in massage-induced analgesia is the gate control theory of pain. This theory, proposed by Melzack and Wall in 1965, posits that the transmission of pain signals from the periphery to the brain is not a linear process but is subject to modulation at the level of the spinal cord. According to the gate control theory, a "gate" mechanism exists in the dorsal horn of the spinal cord, acting as a filter for incoming sensory information. This gate can be opened or closed by the relative activity of different types of nerve fibers. Large-diameter A-beta fibers, which transmit non-nociceptive (non-painful) sensory information, such as touch and pressure, have an inhibitory effect on the gate, tending to close it. Conversely, smaller-diameter A-delta and C fibers, which transmit nociceptive (painful) signals, have an excitatory effect, tending to open the gate.[8,9]

Massage, by stimulating A-beta fibers through the activation of mechanoreceptors, effectively "closes" the gate, thereby inhibiting the transmission of pain signals to the brain. This results in a decrease in the perceived intensity of pain, providing a neurophysiological basis for the analgesic effects of massage. In addition to the gate control mechanism, massage also triggers the release of endorphins, endogenous opioid peptides that play a crucial role in pain modulation. Endorphins are produced in the brain and spinal cord and bind to opioid receptors, which are widely distributed throughout the central and peripheral nervous systems. The binding of endorphins to these receptors inhibits the release of neurotransmitters involved in pain transmission, such as substance P and glutamate. This inhibition disrupts the pain signaling pathway, leading to a reduction in pain perception. Furthermore, endorphins have been shown to induce a sense of euphoria, well-being, and relaxation, which can further modulate pain perception. The release of endorphins during massage may contribute to the positive emotional and psychological effects often reported by individuals receiving massage therapy. The physiological effects of massage extend beyond the nervous system. Massage techniques, particularly those that involve deep tissue manipulation, can increase blood flow and lymphatic circulation. This enhanced circulation delivers oxygen and nutrients to tissues, promoting healing and repair, while also removing metabolic waste products that can contribute to pain and inflammation. Improved circulation can also reduce muscle tension and spasm, which are common sources of pain. Moreover, massage can improve joint mobility and flexibility by reducing stiffness and adhesions in muscles and connective tissues. This can alleviate mechanical stress on joints and surrounding tissues, leading to pain reduction. Massage may also stimulate the production of synovial fluid, which lubricates joints and facilitates smooth movement. In the context of labor pain, massage can be particularly beneficial due to its multifaceted effects. The rhythmic contractions of the uterus during labor can cause significant pain and discomfort. Massage can help to reduce the intensity of these contractions by promoting relaxation and reducing muscle tension. Additionally, massage can alleviate pain in the lower back, hips, and legs, which are common areas of discomfort during labor.[10,11]

Deep breathing relaxation (DBR) complements the physiological effects of massage by engaging the parasympathetic nervous system, the branch of the autonomic nervous system responsible for rest and relaxation. The slow, deep breathing pattern characteristic of DBR increases vagal tone, leading to a decrease in heart rate, blood pressure, and muscle tension. This relaxation response counteracts the stress response, which is often heightened during labor and can exacerbate pain perception. DBR also influences pain perception through psychological mechanisms. The focused attention on the breath serves as a distraction technique, diverting the patient's attention away from pain sensations. This distraction can be further enhanced by incorporating visualization or guided imagery techniques into the DBR practice. Additionally, DBR promotes a sense of control and empowerment, allowing the patient to actively participate in managing her pain. The physiological and psychological benefits of DBR are supported by numerous studies. Research has shown that DBR can reduce anxiety, stress, and pain perception in various clinical settings, including labor and delivery. A study found that pregnant women who practiced DBR during labor reported significantly lower pain scores and anxiety levels compared to those who did not.[12,13]

The synergistic interaction between massage and deep breathing relaxation (DBR) is a multifaceted phenomenon that contributes to their combined efficacy in reducing labor pain. This synergy arises from the complementary physiological and psychological effects of these two modalities, creating a positive feedback loop that amplifies their individual analgesic properties. Massage, as a form of tactile stimulation, initiates a cascade of physiological responses that prime the body for relaxation. The manipulation of soft tissues activates mechanoreceptors in the skin, which transmit signals to the central nervous system. These signals trigger the release of endorphins, endogenous opioids that bind to opioid receptors in the brain, inhibiting pain transmission and inducing a sense of euphoria. Additionally, massage increases blood flow and lymphatic circulation, promoting the removal of metabolic waste products and reducing muscle tension. This physiological relaxation response creates a conducive environment for the deeper relaxation achieved through DBR. Deep breathing relaxation, in turn, enhances the pain-relieving effects of massage by promoting a state of mental calmness and reducing anxiety. The slow, rhythmic breathing pattern characteristic of DBR activates the parasympathetic nervous system, the "rest and digest" branch of the autonomic nervous system. This activation counteracts the stress response, which is often heightened during labor, and triggers a relaxation response characterized by decreased heart rate, blood pressure, and muscle tension. The reduction in anxiety and stress further diminishes pain perception, as these emotional states are known to exacerbate pain.[14,15]

The synergistic interaction between massage and DBR is not solely physiological but also psychological. The tactile stimulation of massage helps to ground the parturient in the present moment, focusing her attention on the physical sensations of touch and pressure. This grounding effect facilitates the transition to DBR, as it becomes easier for the parturient to concentrate on her breath and disengage from the pain experience. The rhythmic breathing pattern of DBR, in turn, reinforces the relaxation response initiated by massage, creating a positive feedback loop that deepens the state of relaxation and further reduces pain perception. The synchronization of breath with massage strokes is another crucial aspect of the synergistic interaction between these two modalities. As the parturient focuses on her breath, the massage therapist can time the strokes to coincide with the inhalation and exhalation phases. This synchronization creates a harmonious rhythm that enhances the relaxation response and promotes a sense of coherence between the mind and body. The patient's awareness of her breath and the rhythmic massage strokes can also serve as a distraction from pain, further contributing to pain reduction. The synergistic interaction between massage and DBR can be conceptualized as a dynamic interplay of physiological and psychological processes. Massage initiates a relaxation response by activating mechanoreceptors, stimulating endorphin release, and increasing blood flow. DBR deepens this relaxation response by activating the parasympathetic nervous system, reducing anxiety, and promoting mental calmness. The tactile stimulation of massage and the rhythmic breathing pattern of DBR work in concert to ground the parturient in the present moment, distract her from pain, and create a positive feedback loop that amplifies their analgesic effects. This synergistic interaction is supported by several lines of evidence. Studies have shown that the combination of massage and DBR is more effective in reducing labor pain than either modality alone. For example, a study found that pregnant women who received both massage and relaxation training during labor reported significantly lower pain scores and required less pain medication than those who received standard care. Another study demonstrated that the combination of massage and DBR was associated with increased maternal satisfaction and a more positive childbirth experience.[15,16]

The synergistic interaction between massage and DBR is a complex and dynamic process that warrants further investigation. Future research should explore the specific mechanisms underlying this synergy, including the role of endorphins, oxytocin, and other neurotransmitters. Additionally, studies should investigate the optimal timing, duration, and frequency of massage and DBR sessions to maximize their combined analgesic effects. The synergistic interaction between massage and DBR is a key factor contributing to their effectiveness in reducing labor pain. This interaction involves a complex interplay of physiological and psychological processes that create a positive feedback loop, amplifying the analgesic effects of each modality. By understanding the mechanisms underlying this synergy, healthcare providers can optimize the use of massage and DBR to provide comprehensive and effective pain relief for women during labor. The synergistic effects of massage and DBR are supported by emerging research. A study found that a combined massage and relaxation intervention was more effective in reducing labor pain and anxiety than either intervention alone. The authors concluded that the two modalities complement each other, with massage addressing the physical aspects of pain and relaxation addressing the psychological aspects.[17,18]

The findings of this RCT have significant implications for clinical practice. The combined massage and DBR intervention offers a safe, effective, and non-pharmacological approach to labor pain management. This approach is particularly appealing due to its minimal side effects and ease of implementation. Midwives and other healthcare providers can be readily trained in these techniques, making them accessible to a wide range of parturient women. Integrating massage and DBR into routine labor care could lead to several benefits. Reduced reliance on pharmacological pain management, which can have adverse effects on both mother and infant. Improved maternal satisfaction and childbirth experience, leading to greater empowerment and a more positive perception of childbirth. Enhanced labor progress due to reduced pain and anxiety, potentially leading to shorter labor duration and fewer complications. Increased maternal-infant bonding due to the calming and relaxing effects of the intervention. Future research should focus on several key areas to further elucidate the benefits and mechanisms of the combined massage and DBR intervention. Larger, multicenter trials are needed to confirm the generalizability of the findings and assess the long-term effects of the intervention on maternal and neonatal outcomes. Additionally, studies should investigate the optimal timing, duration, and frequency of massage and DBR sessions during labor. Further research is also needed to explore the potential of combining massage and DBR with other non-pharmacological pain management techniques, such as aromatherapy, hydrotherapy, and music therapy. The development of comprehensive, multimodal pain management protocols that incorporate a variety of non-pharmacological interventions could offer a personalized and holistic approach to labor pain management, empowering women to choose the techniques that best suit their individual needs and preferences.[19,20]

4. Conclusion

The combination of massage and DBR is a safe and effective non-pharmacological intervention for reducing labor pain intensity. This approach can be easily integrated into standard care practices, offering a valuable tool for improving maternal comfort and well-being during childbirth. Further research is needed to confirm these findings in larger and more diverse populations.

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