

Original Article

The effect of lavender aromatherapy on pain intensity during the active phase of the first stage of labor

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Abstract:

Labor pain during the active phase of the first stage is a multidimensional experience caused by uterine contractions, cervical dilation, cervical effacement, and fetal descent. Uncontrolled pain may increase maternal fear, anxiety, catecholamine release, and perceived discomfort during childbirth. Lavender aromatherapy is a simple non-pharmacological intervention that may support relaxation and pain modulation through olfactory stimulation and limbic-system responses. This study aimed to determine the effect of lavender aromatherapy on pain intensity during the active phase of the first stage of labor among women giving birth at Motoboi Kecil Community Health Center, Kotamobagu City. This quasi-experimental study used a two-group pretest-posttest design. Thirty women in the active phase of the first stage of labor were recruited by total sampling and assigned to an intervention group (n = 15) and a control group (n = 15). Pain intensity was assessed using the Bourbanis Pain Scale observation sheet. The intervention group received lavender aromatherapy, whereas the control group received routine care. Data were analyzed using the Wilcoxon signed-rank test and Mann-Whitney U test. In the intervention group, mean pain intensity decreased from 6.80 ± 0.775 to 5.67 ± 0.900 ($p = 0.003$). In the control group, mean pain intensity increased from 5.47 ± 1.992 to 7.60 ± 1.352 ($p = 0.001$). The post-test comparison showed a significant difference between groups ($p < 0.001$). Lavender aromatherapy effectively reduced the intensity of labor pain during the active phase of the first stage and may be considered as a complementary intervention in midwifery care.

Keywords:

active phase of labor, labor pain, lavender aromatherapy, midwifery care, non-pharmacological therapy

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INTRODUCTION

Labor pain is one of the most intense forms of acute pain experienced by women and is commonly reported during the active phase of the first stage of labor. It results from uterine contractions, cervical dilatation and effacement, stretching of the lower uterine segment, pressure on pelvic structures, and the progressive descent of the fetus. Although labor pain is physiological, it is also strongly influenced by psychological factors, including fear, anxiety, previous birth

experiences, maternal readiness, social support, and the quality of care received from health professionals. Pain that is poorly managed can increase sympathetic nervous system activity, elevate catecholamine levels, reduce uteroplacental blood flow, and intensify maternal fatigue. These mechanisms may interfere with maternal coping, reduce satisfaction with childbirth, and complicate the progress of labor (Bonapace et al., 2018; Lowe, 2002).

The first stage of labor is clinically important because the intensity and frequency of uterine contractions increase as cervical dilatation progresses. During the active phase, pain usually becomes more intense and regular. Pharmacological methods, particularly neuraxial analgesia, can provide strong pain relief, but they may not be available in all maternity settings and may not always be preferred by women. In primary health care and community-based maternity services, midwives frequently need safe, low-cost, acceptable, and easy-to-apply complementary methods to help mothers cope with pain. International evidence supports the use of non-pharmacological approaches as part of woman-centered labor care, especially when they are implemented alongside respectful communication, continuous support, and clinical monitoring (Bohren et al., 2017; Chaillet et al., 2014; Czech et al., 2018; World Health Organization [WHO], 2018).

Non-pharmacological pain management does not replace essential obstetric care. Rather, it complements routine care by helping mothers maintain comfort, calmness, and a sense of control during contractions. Several approaches have been studied, including breathing exercises, massage, hydrotherapy, continuous support, music therapy, reflexology, relaxation, and aromatherapy. A Cochrane overview reported that non-pharmacological approaches may help women cope with labor pain, although the quality and strength of evidence vary between interventions (Jones et al., 2012). Aromatherapy is one of the most practical approaches in midwifery services because it can be administered via inhalation, requires minimal equipment, and is relatively low-cost when used appropriately (Smith et al., 2011; Tabatabaeichehr & Mortazavi, 2020).

Lavender (*Lavandula angustifolia*) is among the most frequently studied essential oils for relaxation and symptom management. Its main constituents, particularly linalool and linalyl acetate, have been associated with sedative, anxiolytic, and analgesic properties. Inhaled lavender aroma is thought to stimulate olfactory receptors, transmit signals to the olfactory bulb, and activate the limbic system, including structures involved in emotional regulation and pain perception. This pathway may reduce arousal, promote relaxation, and modify pain perception through neuroendocrine and autonomic responses (Donelli et al., 2019; Koulivand et al., 2013; Koehler, 2021).

Evidence from systematic reviews suggests that aromatherapy can reduce labor pain and anxiety, particularly during the first stage of labor. A systematic review by Ghiasi et al. (2019) showed that aromatherapy had an anxiolytic effect during the first stage of labor. Another review found that aromatherapy was effective in managing labor pain and anxiety, although variation in essential oil types, duration, administration methods, and outcome measures remains a methodological concern (Tabatabaeichehr & Mortazavi, 2020). More recent evidence also suggests that aromatherapy may reduce the intensity of labor pain, shorten perceived discomfort, and improve maternal relaxation (Yildiz Karaahmet & Bilgic, 2023).

Studies in Indonesia and related clinical contexts provide additional support for complementary interventions. Manaf et al. (2020) reported that lavender and rose aromatherapy reduced the intensity of active-phase childbirth pain. Titisari and Putri (2025) showed that rose aromatherapy reduced anxiety during the active phase of the first stage of labor, while Ajiningwulan et al. (2025)

reported that lavender aromatherapy reduced acute pain among post-cesarean mothers. Abidin and Rachmad's research (2022) highlighted the close association between anxiety and pain in post-cesarean patients, emphasizing the importance of assessing both psychological and pain responses. A systematic review by Imam et al. (2024), of which I was one of the authors, further supported the use of music therapy and aromatherapy as low-cost complementary interventions for reducing preoperative anxiety. These findings strengthen the rationale for integrating aromatherapy into maternal and perioperative care when safety and clinical appropriateness are ensured.

Despite growing evidence, local data on lavender aromatherapy for active-phase labor pain in primary care settings remain limited. At Motoboi Kecil Community Health Center, preliminary observation showed that laboring mothers commonly reported stabbing pain spreading to the waist and lower abdomen, and lavender aromatherapy had not been routinely used as a labor pain management strategy. Therefore, this study was conducted to evaluate the effect of lavender aromatherapy on pain intensity during the active phase of the first stage of labor among women giving birth at the Motoboi Kecil Community Health Center in Kotamobagu City.

METHOD

Study design. This study used a quantitative quasi-experimental design with a two-group pretest-posttest approach. The design was selected because the study aimed to compare pain intensity before and after the intervention in two groups: an intervention group receiving lavender aromatherapy and a control group receiving routine care. The design allowed the researchers to determine within-group changes and between-group differences while maintaining feasibility in a community health center setting.

Setting and participants. The study was conducted from January to February 2025 at Motoboi Kecil Community Health Center, Kotamobagu City. The study population consisted of women in the active phase of the first stage of labor who received care at the health center during the study period. A total of 30 respondents were included: 15 women in the intervention group and 15 women in the control group. The sampling technique was total sampling, in which all eligible women who met the criteria and were present during the data collection period were invited to participate.

Eligibility criteria. Respondents were eligible if they were in the active phase of the first stage of labor, were conscious and able to communicate, agreed to participate, and had no documented allergy or hypersensitivity to lavender aroma. Women with emergency obstetric conditions requiring immediate referral, severe clinical instability, inability to respond to pain assessment, or refusal to participate were excluded. These criteria were established to protect maternal safety and ensure consistent pain assessment.

Intervention. The intervention group received lavender aromatherapy in addition to routine midwifery care. Lavender essential oil was administered by inhalation in the labor room according to the intervention protocol prepared by the research team. The intervention was intended to provide a calming sensory stimulus during contractions and to support maternal relaxation. The control group received routine care without lavender aromatherapy. Both groups continued to receive standard labor monitoring, emotional support, and clinical care in accordance with the health center's

procedure. The intervention was not intended to replace clinical management of labor pain or obstetric decision-making.

Measurement. Pain intensity was assessed using the Bourbonnais Pain Scale observation sheet, as used in the original research protocol. Pain categories were grouped into mild, moderate, controlled severe, and uncontrolled severe pain. Pretest pain assessment was conducted before the intervention period, and posttest pain assessment was conducted after the intervention period in the intervention group and at a comparable time point in the control group. Respondent characteristics included maternal age, education level, and parity.

Data analysis. Data were analyzed using descriptive and inferential statistics. Frequency and percentage were used to describe respondent characteristics and pain categories. The Shapiro-Wilk test was used to assess the normality of pain scores. Because the data were not normally distributed in several measurements, non-parametric tests were applied. The Wilcoxon signed-rank test was used to evaluate differences in pain intensity between pretest and posttest within each group. The Mann-Whitney U test was used to compare pain intensity between the intervention and control groups. A p-value of less than 0.05 was considered statistically significant.

Ethical considerations. This study underwent ethical review and received a letter of ethical approval from the relevant ethics committee. All respondents were informed about the study purpose, procedures, potential benefits, and their right to withdraw. Participation was voluntary, and informed consent was obtained before data collection. Respondent confidentiality was maintained by using anonymous data coding and reporting only aggregated findings.

RESULTS

A total of 30 women in the active phase of the first stage of labor completed the study. Fifteen respondents were included in the intervention group, and 15 in the control group. No respondent was reported as dropping out during data collection.

Table 1. Characteristics of respondents in the intervention and control groups (N = 30)

Characteristic	Category	Intervention (n = 15)	Control (n = 15)	Total (N = 30)
Age	< 20 years	0 (0.0%)	0 (0.0%)	0 (0.0%)
	20-35 years	15 (100.0%)	15 (100.0%)	30 (100.0%)
	> 35 years	0 (0.0%)	0 (0.0%)	0 (0.0%)
Education	High school	5 (33.3%)	5 (33.3%)	10 (33.3%)
	College	10 (66.7%)	10 (66.7%)	20 (66.7%)
Parity	Primigravida	8 (53.3%)	7 (46.7%)	15 (50.0%)
	Multigravida	7 (46.7%)	8 (53.3%)	15 (50.0%)

Table 1 shows that all respondents were aged 20-35 years. Most respondents had a college education, and parity distribution was relatively balanced between primigravida and multigravida.

Table 2. Pain Intensity Categories Before and After Intervention in the Intervention and Control Groups (N = 30)

Pain Category	Intervention group		Control group	
	Pretest n (%)	Posttest n (%)	Pretest n (%)	Posttest n (%)
Mild pain	0 (0.0)	0 (0.0)	4 (26.7)	0 (0.0)
Moderate pain	4 (26.7)	12 (80.0)	6 (40.0)	1 (6.7)
Controlled severe pain	11 (73.3)	3 (20.0)	5 (33.3)	12 (80.0)
Uncontrolled severe pain	0 (0.0)	0 (0.0)	0 (0.0)	2 (13.3)
Total	15 (100.0)	15 (100.0)	15 (100.0)	15 (100.0)

In the intervention group, pain intensity shifted toward lower categories following lavender aromatherapy, with the proportion experiencing moderate pain increasing from 26.7% to 80.0%, while the proportion experiencing severe pain decreased from 73.3% to 20.0%. In contrast, the control group showed a shift toward higher pain intensity, with controlled severe pain increasing from 33.3% to 80.0% and uncontrolled severe pain emerging in 13.3% of participants at posttest.

Table 3. Within- and Between-Group Comparisons of Pain Intensity Before and After the Intervention

Group	Measurement	Mean $\pm$ SD	Min–Max	Mean change	Mean rank	p
Intervention	Pretest	6.80 $\pm$ 0.775	5–8	–1.13	18.50	0.054*
	Posttest	5.67 $\pm$ 0.900	4–7		9.63	<0.001†
Control	Pretest	5.47 $\pm$ 1.992	3–8	+2.13	12.50	
	Posttest	7.60 $\pm$ 1.352	5–10		21.37	
Within-group comparison	Intervention			–1.13		0.003
	Control			+2.13		0.001

Note. SD = standard deviation. Within-group comparisons were performed using the Wilcoxon signed-rank test. Between-group comparisons were performed using the Mann–Whitney U test.

*Pretest between-group comparison.

†Posttest between-group comparison. Statistical significance was set at $p < .05$.

At baseline, pain intensity was slightly higher in the intervention group (6.80 $\pm$ 0.775) than in the control group (5.47 $\pm$ 1.992), but the difference was not statistically significant ($p = 0.054$), indicating comparable baseline pain intensity. Following the intervention, mean pain intensity decreased by 1.13 points in the intervention group, from 6.80 to 5.67, with a statistically significant within-group difference ($p = 0.003$). In contrast, pain intensity increased by 2.13 points in the control group, from 5.47 to 7.60 ($p = 0.001$). The posttest comparison demonstrated a statistically significant difference between groups ($p < 0.001$), with lower pain intensity in the intervention group than in the control group. These findings indicate that lavender aromatherapy was associated with a significant reduction in pain intensity compared with the control condition.

DISCUSSION

This study found that lavender aromatherapy significantly reduced pain intensity during the active phase of the first stage of labor. Before the intervention, most respondents in the intervention

group experienced controlled severe pain. After receiving lavender aromatherapy, most respondents shifted to moderate pain, and the mean pain score decreased by 1.13 points. In contrast, the control group experienced a 2.13-point increase in mean pain score. These findings indicate that pain tends to intensify naturally as labor progresses, but lavender aromatherapy may help reduce perceived pain or slow its escalation during the active phase.

The physiological explanation of labor pain supports the findings. During the first stage of labor, uterine contractions and cervical dilatation activate visceral afferent pathways, while pressure and tissue stretching contribute to somatic discomfort. Pain intensity tends to increase as contraction frequency and cervical dilatation progress. In the absence of supportive pain management, women may experience increased fear and muscle tension, which can further intensify pain perception. The fear-tension-pain cycle is therefore an important target for non-pharmacological intervention. Lavender aromatherapy may reduce pain not by eliminating uterine contraction pain, but by improving relaxation, decreasing arousal, and modifying pain perception through sensory and emotional pathways (Bonapace et al., 2018; Lowe, 2002).

Lavender aromatherapy is biologically plausible as a supportive intervention. The volatile compounds of lavender essential oil, especially linalool and linalyl acetate, are inhaled and processed through olfactory pathways. These signals reach the limbic system, which is involved in emotional regulation, fear response, memory, and pain modulation. A calmer emotional state can reduce sympathetic activation and may help mothers cope with contractions more effectively. Koulivand et al. (2013) described lavender as having potential effects on the nervous system, while Donelli et al. (2019) reported anxiolytic effects of lavender in a systematic review and meta-analysis. Although anxiety and pain are distinct outcomes, they are closely connected during labor because high anxiety can increase pain intensity and reduce coping capacity.

The findings are consistent with broader evidence on aromatherapy in childbirth. Tabatabaeichehr and Mortazavi (2020) reported that aromatherapy was effective in managing labor pain and anxiety, while Ghiasi et al. (2019) found that aromatherapy had anxiolytic benefits during the first stage of labor. Yildiz Karaahmet and Bilgic (2023) also concluded that aromatherapy may reduce labor pain, anxiety, and labor-related discomfort. The present study contributes local evidence from a community health center setting and suggests that lavender aromatherapy is feasible for use in primary maternity care when administered safely and appropriately.

This study also aligns with findings from Indonesian and regional studies. Manaf et al. (2020) reported that lavender and rose aromatherapy reduced active-phase childbirth pain. Another research evidence shows that rose aromatherapy was effective in reducing anxiety during the active phase of labor (Titisari & Putri, 2025), and lavender aromatherapy reduced acute pain among post-cesarean mothers (Ajiningwulan et al., 2025). The article by Abidin and Rachmad (2022) further emphasizes that pain and anxiety are closely related among post-cesarean patients. Collectively, these findings support the value of low-cost sensory interventions in maternal and perioperative care, especially when pharmacological approaches are limited or when women prefer complementary support.

The posttest difference between groups is clinically meaningful. Although the intervention group entered the study with a slightly higher mean pretest pain rank than the control group, the pretest comparison was not statistically significant. At posttest, the intervention group had a much lower mean rank than the control group, indicating better pain control after lavender aromatherapy.

The control group's increase in pain is expected because labor pain normally intensifies as active labor progresses. Therefore, the observed improvement in the intervention group suggests a potential protective effect against pain escalation.

The role of midwives is central in implementing such interventions. Non-pharmacological care requires not only an intervention tool but also a supportive environment, therapeutic communication, privacy, and ongoing assessment. Aromatherapy should be given with attention to maternal preference, allergy history, ventilation, and dose safety. It should not be applied indiscriminately to women with respiratory sensitivity, nausea triggered by odor, or known hypersensitivity to essential oils. When properly used, however, aromatherapy can be part of respectful maternity care because it provides mothers with an additional sense of comfort and involvement in their own coping process.

The inclusion of evidence from music therapy and aromatherapy is also relevant because sensory interventions may influence emotional and physiological responses. Imam et al. (2024) reported that music therapy and aromatherapy were effective in reducing preoperative anxiety in digestive surgery patients. Although that review focused on surgical patients rather than laboring women, the mechanisms are conceptually comparable: both interventions provide sensory input that can reduce arousal and improve emotional regulation. Similarly, Son et al. (2019) showed that combined aromatherapy and music therapy reduced anxiety and stress in nursing students, while Lee et al. (2017) demonstrated the benefits of music and aromatherapy in mechanically ventilated patients. These studies support the broader concept that carefully selected sensory interventions can influence psychological and pain-related outcomes.

The study has several limitations. First, the sample size was small, and the sample was recruited from a single community health center, limiting generalizability. Second, the study was quasi-experimental and did not use random allocation or blinding, which may introduce selection and observer bias. Third, pain is subjective and may be influenced by parity, maternal expectations, cervical dilatation, contraction pattern, fear, family support, and the birth environment. Fourth, the exact concentration and duration of lavender exposure should be standardized more rigorously in future studies. Further research using randomized controlled designs, larger sample sizes, standardized aromatherapy protocols, and additional outcomes, such as maternal anxiety, satisfaction, labor duration, and neonatal outcomes, is recommended.

Despite these limitations, the results support the use of lavender aromatherapy as a complementary intervention for managing labor pain during the active phase of the first stage. The intervention is relatively simple, inexpensive, and feasible in primary maternity services. Its use should remain integrated with evidence-based obstetric monitoring, respectful communication, and timely referral when complications occur.

CONCLUSION

Lavender aromatherapy significantly reduced pain intensity during the active phase of the first stage of labor among women giving birth at Motoboi Kecil Community Health Center, Kotamobagu City. The intervention group showed a decrease in mean pain score from 6.80 to 5.67, while the control group showed an increase from 5.47 to 7.60. The posttest comparison between groups was

statistically significant ($p < 0.001$), indicating that lavender aromatherapy was effective as a complementary, non-pharmacological intervention for managing labor pain. Midwives may consider lavender aromatherapy as part of supportive maternity care, provided that maternal safety, allergy history, and clinical monitoring are ensured.

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AI USE DECLARATION

Artificial intelligence tools were used only to assist with language refinement, grammar checking, and improving manuscript clarity. The authors remain fully responsible for the content, analysis, interpretation, and final version of the article.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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