

Original Article

The combined effect of lavender aromatherapy and classical lullaby music on anxiety levels among women awaiting caesarean section

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Abstract:

Women awaiting caesarean section commonly experience preoperative anxiety, which can intensify physiological stress, reduce cooperation during preparation, and worsen postoperative recovery. Non-pharmacological interventions such as lavender aromatherapy and calming music are increasingly used as complementary approaches because they are simple, low-cost, and acceptable in maternity care. This study examined the effect of combined lavender aromatherapy and classical lullaby music on anxiety levels among women awaiting caesarean section at Kasih Utama Fatimah Hospital, Kotamobagu. A quasi-experimental one-group pretest-posttest design was used. Forty pre-caesarean section women were recruited through consecutive sampling. Anxiety was measured before and after a 30-minute combined intervention using an anxiety scale categorized into no, mild, moderate, and severe anxiety. Data were analyzed using descriptive statistics and the Wilcoxon signed-rank test. Before the intervention, most respondents experienced severe anxiety (87.5%), while the remaining respondents had moderate anxiety (12.5%). After the intervention, 77.5% reported no anxiety and 22.5% had mild anxiety. The Wilcoxon test showed a significant reduction in anxiety after the intervention ($p < 0.001$). The combined use of lavender aromatherapy and classical lullaby music significantly reduced anxiety among women awaiting caesarean section. This intervention can be considered as a supportive, non-pharmacological strategy in preoperative maternity care while further controlled studies are recommended.

Keywords:

anxiety, caesarean section, classical lullaby music, lavender aromatherapy, non-pharmacological intervention

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DOI: <https://doi.org/10.53713/pfcj.vxix.xxx>

Article Info:

Submitted:
17-03-2025
Accepted:
24-06-2025
Published:
30-06-2025

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INTRODUCTION

Caesarean section is an essential obstetric procedure that saves the lives of mothers and infants when vaginal birth poses unacceptable risks. Its use has increased worldwide, reflecting improvements in surgical access, referral systems, obstetric surveillance, and maternal preference, but it also requires careful preparation because surgery itself can trigger physiological and psychological stress. Global analyses show that caesarean section rates have increased substantially across regions, with marked differences between and within countries (Betran et al.,

2021; Boerma et al., 2018). Although medically indicated caesarean delivery is beneficial, it is still a major abdominal operation. Women may fear anesthesia, surgical complications, postoperative pain, delayed mobilization, breastfeeding difficulties, and the safety of the newborn. These concerns are clinically relevant because maternal anxiety before surgery may influence hemodynamic stability, pain perception, cooperation with care, and early recovery (Poehlmann et al., 2022; Sandall et al., 2018).

Preoperative anxiety is particularly important in maternity care because the woman is not only preparing for surgery but also anticipating the birth of her baby. Anxiety before caesarean section may be influenced by age, parity, education, previous birth experience, obstetric complications, social support, knowledge about surgery, and the quality of information provided by health professionals. Women undergoing their first birth may perceive caesarean section as unfamiliar and threatening, while women with previous negative birth experiences may anticipate recurrence of pain or complications. Studies of childbirth fear and maternal anxiety show that psychological distress before birth is shaped by perceived risk, self-efficacy, previous trauma, and interaction with health providers (Bayrampour et al., 2016; Çankaya & Şimşek, 2021; Kalok et al., 2025). In postoperative caesarean patients, anxiety has also been associated with pain, indicating that anxiety management should be integrated into perioperative nursing and midwifery care (Abidin et al., 2022).

Non-pharmacological interventions are increasingly recommended as complementary strategies to support women before caesarean section. Such interventions do not replace standard medical care; rather, they help reduce emotional discomfort and promote relaxation. They are usually inexpensive, easy to implement, and acceptable for women who prefer minimal medication before birth. Two frequently used modalities are aromatherapy and music therapy. Aromatherapy works through inhalation of volatile aromatic compounds that stimulate the olfactory pathway and influence the limbic system, which is involved in emotion, memory, and autonomic regulation. Lavender essential oil, derived mainly from *Lavandula angustifolia*, is among the most widely studied aromatherapy agents. Its principal constituents, including linalool and linalyl acetate, have been associated with sedative, anxiolytic, and relaxation effects (Ali et al., 2015; Koulivand et al., 2013). Systematic reviews and trials suggest that lavender inhalation can reduce anxiety in several preoperative and clinical settings (Donelli et al., 2019; Huang et al., 2021; Jaruzel et al., 2019; Koehler, 2021; Yoo & Park, 2023).

Music therapy is another evidence-based complementary intervention for anxiety reduction. Music can modulate attention, affective processing, autonomic arousal, and reward pathways. Neurobiological evidence suggests that pleasurable music can activate dopaminergic reward circuits, while clinical studies show that music listening may reduce anxiety, pain, and stress responses before and after surgery (Bradt et al., 2013; Ferreri et al., 2019; Köhlmann et al., 2018; Lee et al., 2017; Liang et al., 2021). Lullaby music is characterized by slow tempo, simple melody, predictable rhythm, and repetitive patterns. These features may provide a calming auditory stimulus and be particularly relevant in maternity care, as lullabies are culturally associated with comfort, bonding, and maternal-infant interaction. Evidence from neonatal and maternity settings shows that lullaby-based interventions can stabilize physiological responses and support relaxation (Loewy et al., 2013). Recent Indonesian studies also support the use of music and aromatherapy interventions for anxiety management in clinical and maternal contexts (Imam et al., 2024; Kartaatmaja et al., 2025; Titisari & Putri, 2025).

The combination of lavender aromatherapy and classical lullaby music may provide a multimodal relaxation stimulus through both olfactory and auditory pathways. Theoretically, lavender aromatherapy may reduce emotional arousal through olfactory-limbic mechanisms, while lullaby music may regulate affective and autonomic responses through rhythmic auditory stimulation. When used together, these two modalities may enhance relaxation more effectively than either modality alone, especially in a short preoperative period. However, evidence in women awaiting caesarean section remains limited, particularly in Indonesian hospital settings. The present study, therefore, examined whether a combined lavender aromatherapy and classical lullaby music intervention reduced anxiety levels among women awaiting cesarean section at Kasih Utama Fatimah Hospital, Kotamobagu.

METHOD

This study used a quantitative quasi-experimental design with a one-group pretest-posttest approach. The design was selected to evaluate changes in anxiety levels among women awaiting caesarean section before and after receiving a combined lavender aromatherapy and classical lullaby music intervention. Although the design does not include a control group, it is appropriate for preliminary clinical evaluation in a routine hospital setting where the intervention is simple, non-invasive, and delivered as supportive care.

The study was conducted at Kasih Utama Fatimah Hospital, Kotamobagu, in May 2025. The target population consisted of women scheduled for caesarean section. A total of 40 respondents were recruited through consecutive sampling within the predetermined data collection period. Eligible respondents were women awaiting caesarean section who were conscious, able to communicate, willing to participate, and able to receive the aromatherapy and music intervention. Women with emergency conditions requiring immediate surgical transfer or those who were unable to complete the pretest and posttest assessment were not included.

The intervention consisted of simultaneous lavender aromatherapy and classical lullaby music. Lavender aromatherapy was administered via inhalation using lavender essential oil prepared in a diffuser or an equivalent aromatherapy medium, placed at a safe distance from the respondent. Classical lullaby music was played through an audio device at a comfortable volume. The intervention was delivered for approximately 30 minutes during the preoperative waiting period. During the intervention, respondents were encouraged to rest comfortably, breathe normally, and listen to the music while inhaling the lavender aroma. The intervention was designed as a supportive relaxation measure and did not interfere with routine preoperative care, clinical monitoring, or surgical preparation.

Anxiety was measured before and after the intervention using an anxiety assessment sheet categorized into four levels: no anxiety, mild anxiety, moderate anxiety, and severe anxiety. The scoring structure was aligned with commonly used clinical anxiety categorization, where higher scores indicate greater anxiety severity. The Hamilton Anxiety Rating Scale remains a widely recognized measure for clinical anxiety assessment and supports interpretation of symptom severity in research and practice (Hamilton, 1959). Demographic and obstetric characteristics were collected, including maternal age, education level, and parity.

Data were analyzed using descriptive and inferential statistics. Respondent characteristics and anxiety categories were summarized using frequency and percentage. The Shapiro-Wilk test indicated that the anxiety score data were not normally distributed; therefore, the Wilcoxon signed-rank test was used to compare pretest and posttest anxiety scores. Statistical significance was set at $p < .05$. The analysis focused on determining whether the combined lavender aromatherapy and classical lullaby music intervention produced a significant reduction in anxiety levels among women awaiting cesarean section.

All respondents received an explanation of the study's purpose, procedure, voluntary nature, potential benefits, and minimal risks before participating. Respondents were allowed to decline or withdraw without affecting their care. Informed consent was obtained before data collection. Confidentiality was maintained by using aggregated data in the reporting process. The intervention was non-invasive and was delivered as complementary support alongside standard hospital procedures.

RESULT

Forty women awaiting caesarean section completed both the pretest and posttest assessments. No respondent withdrew during the intervention period. The findings are presented in three tables: respondent characteristics, anxiety levels before and after intervention, and the Wilcoxon signed-rank test result. Table 1 shows that all respondents were aged 20-35 years. Most respondents had college or university education (75.0%), and slightly more than half were primigravida (52.5%).

Table 1. Characteristics of pre-caesarean section respondents at Kasih Utama Fatimah Hospital, Kotamobagu (n = 40)

Characteristic	Frequency (n)	Percentage (%)
Age		
20-35 years	40	100
Education		
High school	10	25.0
College/university	30	75.0
Parity		
Primigravida	21	52.5
Multigravida	19	47.5

Table 2. Anxiety Levels Before and After the Lavender Aromatherapy and Classical Lullaby Music Intervention (N = 40)

Anxiety level	Pretest, n (%)	Posttest, n (%)
No anxiety	0 (0.0)	31 (77.5)
Mild anxiety	0 (0.0)	9 (22.5)
Moderate anxiety	5 (12.5)	0 (0.0)
Severe anxiety	35 (87.5)	0 (0.0)
Total	40 (100.0)	40 (100.0)

Before the intervention, most participants experienced severe anxiety (87.5%), while 12.5% experienced moderate anxiety. Following the lavender aromatherapy and classical lullaby music intervention, 77.5% of participants reported no anxiety, and 22.5% reported mild anxiety, with no participants remaining in the moderate or severe anxiety categories. These findings indicate a marked shift toward lower anxiety levels following the intervention.

Table 3. Wilcoxon signed-rank test of anxiety score before and after intervention

Measurement	n	Mode	Median	Range	Negative ranks	p-value
Pretest anxiety score	40	31	31.00	10	40	< 0.001
Posttest anxiety score	40	12	12.00	12		

The Wilcoxon signed-rank test showed that all respondents had lower anxiety scores after the intervention than before. The p-value was less than 0.001, indicating a statistically significant reduction in anxiety after combined lavender aromatherapy and classical lullaby music.

DISCUSSION

This study found a significant decrease in anxiety among women awaiting caesarean section after receiving combined lavender aromatherapy and classical lullaby music. Before the intervention, nearly all respondents experienced severe anxiety; after the intervention, most respondents reported no anxiety, and the remaining respondents reported only mild anxiety. The Wilcoxon signed-rank test confirmed a significant pretest-posttest difference, indicating that the combined intervention was associated with a meaningful reduction in anxiety. This result supports the growing body of evidence that non-pharmacological approaches can be used as complementary interventions to improve emotional comfort during the preoperative period (Huang et al., 2021; Imam et al., 2024; Lee et al., 2017).

The high level of anxiety before intervention is understandable because caesarean section is a major surgical event. A woman awaiting cesarean section may experience fear of anesthesia, postoperative pain, bleeding, infection, surgical failure, delayed recovery, and concern about the baby. Physiological responses to anxiety, such as increased pulse, blood pressure, muscle tension, and restlessness, may complicate preoperative preparation and decrease maternal comfort. Previous studies have shown that anxiety is a clinically important perioperative issue and that women with higher maternal anxiety may experience greater pain and higher opioid use after caesarean delivery (Poehlmann et al., 2022). In the Indonesian study by Abidin et al. (2022), anxiety was also associated with pain intensity among postoperative caesarean patients, reinforcing the need to address anxiety before and after surgery.

Lavender aromatherapy likely contributed to the reduction in anxiety through olfactory stimulation and modulation of the limbic system. The scent molecules from lavender essential oil are inhaled through the nose and transmitted to the olfactory bulb, then to limbic structures involved in emotional regulation. Lavender contains linalool and linalyl acetate, compounds associated with

sedative and anxiolytic properties (Ali et al., 2015; Koulivand et al., 2013). Meta-analytic evidence indicates that lavender aromatherapy has a beneficial effect on anxiety, particularly when delivered through inhalation (Donelli et al., 2019; Yoo & Park, 2023). In preoperative settings, lavender aromatherapy has been reported as a feasible nurse-driven intervention that can reduce anxiety without significant adverse effects (Jaruzel et al., 2019; Koehler, 2021). The present findings are also consistent with an article reporting the implementation of lavender aromatherapy in post-caesarean care, which supports the use of lavender as a complementary nursing strategy in maternal surgical contexts (Ajiningwulan et al., 2025).

Classical lullaby music may have reduced anxiety by providing rhythmic auditory stimulation, cognitive distraction, emotional soothing, and autonomic relaxation. Music listening is believed to influence attention, mood, and physiological arousal. It may activate reward mechanisms, including dopaminergic pathways, and promote the release of endogenous substances associated with comfort (Ferreri et al., 2019). Systematic reviews indicate that music interventions can reduce preoperative anxiety and may be useful in surgical care when applied before procedures (Bradt et al., 2013; Kühlmann et al., 2018; Liang et al., 2021). Lullaby music may be particularly relevant for pregnant and perinatal women because its slow tempo, simple melody, and repetitive pattern are culturally associated with nurturing, calmness, and maternal-infant bonding. This is supported by evidence showing that music therapy can stabilize physiological outcomes and promote relaxation in perinatal and neonatal contexts (Loewy et al., 2013).

The combined intervention may have produced a stronger calming effect because it simultaneously stimulated two sensory pathways. Lavender aromatherapy provided a relaxing olfactory stimulus, while classical lullaby music provided a calming auditory stimulus. The olfactory and auditory systems both connect with brain regions involved in emotion, memory, and stress regulation. When these modalities are used together, they may promote relaxation through complementary mechanisms: reduced arousal, distraction from surgical fear, pleasant sensory engagement, and improved perception of safety. This is consistent with studies suggesting that combining music and aromatherapy can stabilize emotional and physiological responses in clinical patients (Imam et al., 2024; Kumala et al., 2018; Lee et al., 2017). The inclusion is particularly relevant because it highlights the potential of music therapy and aromatherapy for preoperative anxiety management (Imam et al., 2024).

Respondent characteristics may also help explain the findings. All respondents were aged 20-35 years, a range generally considered reproductive, with relatively mature cognitive and emotional capacities. However, maturity does not eliminate anxiety when a woman faces surgery, especially when fetal safety and maternal recovery are involved. Most respondents had a college education, which may improve their ability to understand information, but higher education can also increase awareness of possible risks. Slightly more than half of the respondents were primigravida; women experiencing childbirth for the first time may be more vulnerable to uncertainty and fear because they have no previous birth experience. Prior evidence suggests that fear of childbirth is influenced by parity, prior information, perceived control, and provider interaction (Bayrampour et al., 2016; Çankaya & Şimşek, 2021; Kalok et al., 2025).

The clinical implication of this study is that lavender aromatherapy and classical lullaby music can be incorporated into preoperative maternity care as a simple and low-risk supportive intervention. Midwives and nurses can prepare a calming environment during the waiting period

before caesarean section by using safe aromatherapy practices and soothing music with patient consent. This may help reduce anxiety, improve maternal cooperation, and increase comfort before surgery. The intervention is inexpensive and practical, but implementation should account for allergies, asthma, patient preferences, sensitivity to scents, cultural acceptability, and infection-prevention protocols for shared devices. The intervention should also be delivered as a complement to, not a replacement for, accurate preoperative education, emotional support, and standard medical care.

Several limitations should be acknowledged. First, the study used a one-group pretest-posttest design without a control group, so the reduction in anxiety cannot be attributed solely to the intervention with the same certainty as in a randomized controlled trial. Second, the sample size was limited to 40 respondents from one hospital, which may limit generalizability. Third, the study measured short-term anxiety reduction following a single intervention and did not assess longer-term outcomes, including intraoperative cooperation, postoperative pain, breastfeeding initiation, mobilization, or patient satisfaction. Fourth, the study combined lavender aromatherapy and classical lullaby music, so the separate effects of each modality cannot be determined. Future research should use randomized controlled designs comparing lavender aromatherapy alone, music alone, a combined intervention, and standard care, with larger sample sizes and longer follow-up periods.

CONCLUSION

Combined lavender aromatherapy and classical lullaby music significantly reduced anxiety levels among women awaiting caesarean section at Kasih Utama Fatimah Hospital, Kotamobagu. Before the intervention, most respondents had severe anxiety, whereas after the intervention, most respondents reported no anxiety, and the remainder had mild anxiety. The intervention is feasible as a supportive non-pharmacological strategy in preoperative maternity care. Further randomized controlled studies are recommended to confirm effectiveness and determine the optimal duration, timing, and separate contribution of each intervention component.

ACKNOWLEDGEMENT

The authors thank the management and health personnel of Kasih Utama Fatimah Hospital, Kotamobagu, and all respondents who participated in this study.

AI USE DECLARATION

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

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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