ORIGINAL ARTICLE

Comparison between Lavender and Chamomile Essential Oils for Pain and Anxiety Reduction during Amniocentesis in Second Trimester Pregnancy: A Randomized Controlled Trial

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Objective: To investigate the effectiveness of aromatherapy using lavender and chamomile essential oils, to alleviate pain and reduce anxiety during the amniocentesis procedure in second trimester pregnancy.

Materials and Methods: The present was a randomized controlled trial approved by the Human Research Ethics Committee of Thammasat University (MTU-EC-OB-1-023/66) and registered in the Thai Clinical Trials Registry on June 29, 2023 (TCTR20230629001). The present study was conducted at the Maternal and Fetal Medicine Unit, Thammasat University Hospital, Pathum Thani, Thailand between July and November 2023. The participants were pregnant women undergoing amniocentesis. Participants were randomly assigned into three groups, lavender, chamomile, and normal saline, which was the control group. Participants in each group were instructed to inhale the assigned scent, lavender, chamomile, or normal saline, for 15 minutes prior to the amniocentesis procedure. For each participant, a cotton swab containing four drops of the assigned scent was held 10 centimeters from the participant's nose. Pain and anxiety were recorded using visual analog scale (VAS) and visual facial anxiety scale (VFAS). Expected pain and anxiety were recorded before amniocentesis (Te), immediate after procedure (T0), and at 15 and 30 minutes after the procedure (T15 and T30).

Results: One hundred fifty participants were allocated into three groups. To ensure comparability, demographic characteristics were matched across the three groups. The present study revealed that both lavender and chamomile lowered pain more than the control at 15 minutes after amniocentesis (T15), and only lavender can reduce pain during the procedure (T0). Both lavender and chamomile reduced anxiety more than the control 15 minutes after amniocentesis (T15), and only chamomile continued to reduce anxiety 30 minutes post procedure (T30). Thus, lavender proved to be more effective in managing pain during the amniocentesis procedure, whereas chamomile offers a prolonged effect in reducing anxiety, lasting up to 30 minutes post-procedure.

Conclusion: Aromatherapy effectively reduces pain and anxiety associated with amniocentesis. In the present study. Both lavender and chamomile reduced pain at 15 minutes after the procedure, but only lavender has efficacy in pain reduction during the procedure. Both lavender and chamomile reduced anxiety 15 minutes after the procedure, but only chamomile continued to reduce anxiety 30 minutes post procedure. However, when comparing lavender and chamomile, there was no statistically significant difference in efficacy of pain or anxiety reduction.

Keywords: Lavender; Chamomile; Aromatherapy; Essential oil; Amniocentesis; Pain; Anxiety

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Amniocentesis is an invasive prenatal diagnostic procedure commonly performed during the second trimester for fetal chromosome study. It provides essential data for comprehensive pregnancy management. Indications for amniocentesis include advanced maternal age, chromosome abnormalities suspected from screening tests, previous offspring with chromosome abnormalities, and prior ultrasonographic diagnosis of fetal malformations. The process of amniocentesis involves aspiration of amniotic fluid through the abdominal wall of a pregnant woman to obtain a sample for fetal cell culture and chromosome study.

However, amniocentesis can induce anxiety and pain in pregnant woman. A 2002 study by Ferber et al.[1] indicated that the anticipated pain and anxiety level

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before the procedure tends to be higher than the actual pain and anxiety experienced during the procedure. A study by Klages et al.[2] showed that level of pain during amniocentesis was related with the anxiety level before the procedure. Providing a method to reduce pain and anxiety during the procedure could encourage women to undergo amniocentesis.

Pain and anxiety are factors that discourage women from undergoing amniocentesis to detect fetal abnormalities. As amniocentesis is a primary operation used to study the fetal chromosome, there have been studies to identify methods for pain and anxiety reduction during and after the amniocentesis process. In 2021, Benchahong et al.[3] demonstrated that cold therapy effectively reduced pain both before and after the amniocentesis procedure. A similar study by Hanprasertpong et al.[4] demonstrated that cryoanalgesia is an effective method for reducing pain during amniocentesis. Hanprasertpong et al.[5] investigated the efficacy of listening to music in pain reduction during amniocentesis. The result was that music was not significantly effective at reducing pain during amniocentesis. Another study by Hanprasertpong et al.[6] indicated that aroma therapy using menthol did not exhibit significant efficacy in reducing pain and anxiety during amniocentesis. In 2023, Mahmoud & Allam[7] conducted a meta-analysis comparing the effectiveness of various treatments in reducing amniocentesis-associated pain and anxiety. The study revealed that the most effective method for reducing pain involved a combination of virtual reality with paracetamol. The most effective approach for anxiety reduction was found to be a combination of ice gel pack with H7 acupressure.

Aromatherapy, using scents from essential oils, is an alternative approach to reduce labor pain and anxiety, as demonstrated by Tabatabaeichehr & Mortazavi[8]. Inhaling essential oils can activate the olfactory system and receptors within the central nervous system and initiate psychophysiological changes that affect inhibitory neurons associated with anxiety, depression, and pain reduction. Lavender, in essential oil form, has demonstrated pain and inflammation reduction after cesarean sections, as shown in the study by Olapour et al[9]. A study by Zardosht et al.[10] in 2020 demonstrated that chamomile had significant effects in reducing pain and the need for postoperative pain control after cesarean delivery. Furthermore, a study by Jones et al.[11] showed that aromatherapy was safe to use during pregnancy.

Thus, lavender and chamomile can be used safely as aromatherapy in pregnant women, and they both have pain and anxiety reducing properties. The present study aimed to investigate the effectiveness of lavender and chamomile essential oils in reducing pain and anxiety levels during amniocentesis.

Materials and Methods

Pregnant women between 15 and 20 weeks of gestational age who underwent genetic amniocentesis between July and November 2023 were enrolled in this prospective randomized controlled trial at the Maternal-Fetal Medicine Unit (MFM), Thammasat University Hospital, Pathum Thani, Thailand. The exclusion criteria included multifetal pregnancy, severe congenital anomaly previously detected by ultrasonography, contraindications for amniocentesis, multiple needle puncture attempts during the procedure, changing the amniocentesis puncture position due to fetal movement, mental health disorders, skin infections in the abdominal region, history of allergies to lavender or chamomile scents, olfactory problems such as cold, sinusitis, or COVID-19 infection, and refusal to participate in the present study.

The present research was approved by the Human Research Ethics Committee of Thammasat University (MTU-EC-OB-1-023/66) and registered in the Thai Clinical Trials Registry on June 29, 2023 (TCTR20230629001).

Pregnant women who arranged for second trimester amniocentesis were recruited by consecutive sampling method and approached by staff of the MFM. Participants were counseled about the process of the study and informed that they have the right to refuse to participate in the study or withdraw from the study at any point.

Inclusion and exclusion criteria were reviewed, and then informed consent was obtained from each participant. Research assistants divided the participants into three groups by conducting a random drawing of slips, each labeled lavender (Lav), chamomile (Cha), or control (Con) and enclosed within opaque envelopes.

Demographic data were recorded from each participant including age, body weight, height, education, occupation, income, gestational age, parity, previous delivery, history of abortion, underlying illness, previous obstetrical or gynecological surgery, parity, and history of genetic amniocentesis in a previous gestation.

The visual facial anxiety scale (VFAS) is used to evaluate anxiety level. A study by Cao et al.[12]

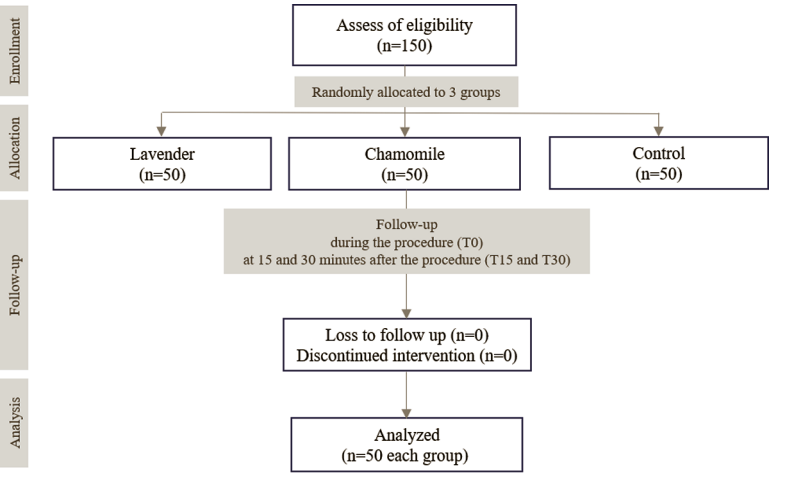

Figure 1. Flow chart of study.

Lavender: inhaled lavender essential oil 15 minutes prior to the amniocentesis, Chamomile: inhaled chamomile essential oil 15 minutes prior to the amniocentesis, Control: inhaled normal saline 15 minutes prior to the amniocentesis

and a study by Yumul et al.[13] both showed that VFAS is a valid tool for measuring acute anxiety and offered a reliable method for assessing anxiety levels in postoperative patients. VFAS is simple to administer, making it practical for use in evaluated anxiety in time-sensitive operative settings. The authors used a VFAS to evaluate anxiety and a visual analog scale (VAS) to evaluate pain. Psychometric measuring scales for pain and anxiety were recorded by making a mark along a 10-cm horizontal line (0 to 10) from no pain or anxiety (score 0) to the worst pain or anxiety (score 10).

Each participant inhaled a specific scent, either lavender essential oil, chamomile essential oil, or normal saline, from a cotton swab placed 10 centimeters from the nose for 15 minutes prior to amniocentesis. All participants underwent ultrasonography to identify fetal anomalies, amniotic fluid, and location of placenta. Amniocentesis was performed under ultrasonographic guidance by MFM staff. Aspiration of amniotic fluid was done using a 22-gauge spinal needle under antiseptic technique. Fetal cardiac activity was recorded immediately after completing the procedure. Puncture sites were covered with waterproof occlusive dressings by assistant nurses. Immediately after the procedure, pain, and anxiety levels before (Te), during (T0), and after amniocentesis at 15 (T15), and 30 (T30) minutes were recorded using VAS. After amniocentesis, patients were observed for post procedure complications and fetal heart sounds for 30 minutes. Additionally, participants were observed by the medical team for complications from the inhaled agents before they were discharged.

The sample size was calculated based on the standard deviation (SD) of post-procedure pain and anxiety observed in the control group (SD 1.94) in a study by Najafi et al[14]. The significance levels, alpha and beta, were set at 0.01 and 0.10, respectively. At least 41 participants in each group would yield an 80% statistical power. To accommodate a potential 20% dropout rate, an additional 25% of the total number of participants was added. Therefore, the number of participants in each group was adjusted to 50. Statistical analyses were calculated by IBM SPSS Statistics for Windows, version 27.0 (IBM Corp., Armonk, NY, USA). Continuous and categorical data were assessed for statistical differences using the t-test, chi-square test, repeated measures ANOVA, and pairwise comparisons to determine significantly different. A p-value of less than 0.05 was considered statistically significant (Figure 1).

The outcome of the present study was measurements of pain and anxiety using VAS and VFAS at specific time points, before amniocentesis, during the procedure, and 15 minutes and 30 minutes after the procedure. Additionally, the study aimed to evaluate and compare the efficacy of aromatherapy using lavender and chamomile essential oils to reduce pain and anxiety during amniocentesis.

Results

One hundred fifty participants were recruited during the study period and divided into three groups. The mean maternal age was 36.80 years old, with an average body mass index (BMI) of 29.45 kg/m².

Table 1. Demographic characteristics of amniocentesis cases (n=50 cases per group)

	Control	Lavender	Chamomile	p-value
Age (years); mean±SD	36.68±4.6	37.34±4.3	36.40±4.6	0.57
BMI (kg/m^2); mean±SD	25.72±7.1	24.39±3.9	25.96±5.5	0.33
Nulliparity; n (%)	14 (28)	19 (38)	13 (26)	0.38
Education level; n (%)				0.85
Primary or lower	4 (8)	6 (12)	3 (6)	
Secondary	25 (50)	22 (44)	25 (50)	
Bachelor or higher	21 (42)	22 (44)	22 (44)	
History of surgery; n (%)	14 (28)	8 (16)	18 (36)	0.07
History of amniocentesis; n (%)	6 (12)	1 (2)	4 (8)	0.16
Indication; n (%)				0.11
Advanced age	40 (80)	42 (84)	39 (78)	
Chromosome abnormality	1 (2)	4 (8)	1 (2)	
Abnormal PND	5 (10)	4 (8)	10 (20)	
Patient's need	2 (4)	0 (0)	0 (0)	

BMI=body mass index; PND=prenatal diagnostic; SD=standard deviation

Lavender: inhaled lavender essential oil 15 minutes prior to the amniocentesis, Chamomile: inhaled chamomile essential oil 15 minutes prior to the amniocentesis, Control: inhaled normal saline 15 minutes prior to the amniocentesis, Advanced age: maternal age ≥35 years old, Chromosome abnormality: family history of chromosome abnormality, Abnormal PND: abnormal prenatal screening test, History child morbidity: previous child with chromosome abnormality

Table 2. Comparison of pain and anxiety scores (VAS and VFAS) during amniocentesis in lavender, chamomile, and control groups (n=50 cases per group)

	Control; mean±SD	Lavender; mean±SD	Chamomile; mean±SD	p-value		
				Con vs. Lav	Con vs. Cha	Lav vs. Cha
Pain (VAS)						
Te	6.46±2.1	6.00±2.4	6.02±2.5	0.583	0.610	0.999
T0	4.12±2.4	3.00±1.6	3.26±1.8	0.014	0.078	0.787
T15	2.44±1.9	1.72±1.1	1.70±1.4	0.046	0.039	0.998
T30	1.74±1.4	1.40±0.9	1.26±0.9	0.272	0.077	0.800
Anxiety (VFAS)						
Te	6.46±2.9	6.06±3.0	6.36±2.7	0.767	0.984	0.861
T0	4.32±2.8	3.92±2.5	3.82±2.6	0.727	0.608	0.980
T15	2.86±2.2	1.66±1.1	1.74±1.3	<0.001	0.002	0.967
T30	2.04±2.2	1.42±1.0	1.26±0.8	0.089	0.023	0.848

SD=standard deviation; VAS=visual analog scale; VFAS=visual facial anxiety scale

VAS: range 0 to 10, Lavender: inhaled lavender essential oil 15 minutes prior to the amniocentesis, Chamomile: inhaled chamomile essential oil 15 minutes prior to the amniocentesis, Control: inhaled normal saline 15 minutes prior to the amniocentesis, Te: expected VAS/VFAS before amniocentesis, T0: VAS/VFAS during amniocentesis, T15: VAS/VFAS at 15 minutes after amniocentesis, T30: VAS/VFAS at 30 minutes after amniocentesis, Con vs. Lav: between control and lavender group, Con vs. Cha: between control and chamomile group, Lav vs. Cha: between lavender and chamomile group

Half of the participants (65 out of 150) had higher education than bachelor's degree. One quarter (40 out of 150) of the participants had a history of abdominal surgery, and 7.3% had prior experience with amniocentesis. Statistical analysis revealed no significant differences among the groups concerning maternal age, BMI, parity, education, history of abdominal surgery, and prior amniocentesis at the time of randomization (Table 1).

The results of the present study using repeated measures ANOVA and pairwise comparisons revealed that inhalation of both lavender and chamomile had efficacy in pain and anxiety reduction in amniocentesis procedure (Table 2).

In terms of pain reduction, inhalation of lavender essential oil 15 minutes before amniocentesis lead to a statistically significant reduction in pain both during the amniocentesis (T0) and 15 minutes after amniocentesis (T15). Chamomile also exhibited statistically significant reduction in pain at 15 minutes after amniocentesis (T15) (Figure 2A).

In terms of anxiety reduction, lavender essential

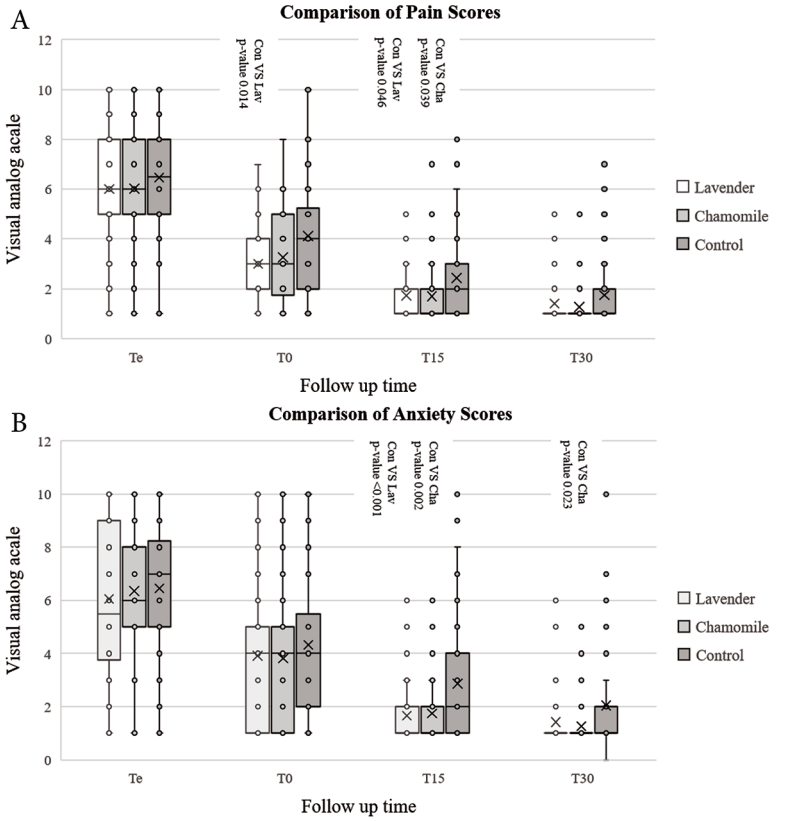

Figure 2. (A) Comparison of pain scores (visual analog scale, VAS) during amniocentesis in lavender, chamomile, and control groups. (B) Comparison of anxiety scores (visual facial anxiety scale, VFAS) during amniocentesis in lavender, chamomile, and control groups.

Lavender: inhaled lavender essential oil 15 minutes prior to the amniocentesis, Chamomile: inhaled chamomile essential oil 15 minutes prior to the amniocentesis, Control: inhaled normal saline 15 minutes prior to the amniocentesis

oil showed statistically significant reduction in anxiety at 15 minutes after amniocentesis (T15). Chamomile had also significantly reduced anxiety at both 15 minutes and 30 minutes after amniocentesis (T15 and T30) (Figure 2B).

Discussion

The use of aromatherapy in pain and anxiety reduction has attracted significant attention recently. Studies have revealed that aromatherapy is effective in reducing postoperative pain and anxiety. Moreover, aromatherapy has shown efficacy in reducing pain and anxiety in many medical procedures, such as venipuncture and amniocentesis.

Previous studies from Noruzi Zamenjani et al.[15] investigated the effectiveness of inhaling sweet orange and Damask rose essential oils in reducing postoperative abdominal pain. The results, assessed using a VAS, revealed a significant reduction in pain levels after inhaling four drops of essential oil for 30 minutes compared to the placebo group. A study by Zamani Habibabad et al.[16] showed that chamomile aromatherapy could significantly reduce post-cesarean section pain.

Lavender essential oil has also shown efficacy in post-cesarean section pain reduction. A study in 2020 by Abbasijahromi et al.[17] explored the efficacy of lavender and Damask rose essential oils in reducing pain and anxiety after cesarean section. The study used both VAS and Spielberger State-Trait Anxiety Inventory to evaluate pain and anxiety levels. The results indicated a significant reduction in postoperative pain and anxiety levels from both lavender and Damask rose essential oils. A study by Hadi & Hanid[18] showed a similar result, that lavender essence could significantly decrease mean VAS in post-cesarean section pain. A study by Çalışır et al.[19] revealed that lavender aromatherapy could significantly reduce intraoperative anxiety for cesarean section. Lavender has also reduced pain and anxiety during venipuncture. In 2016, Karaman et al.[20] study compared lavender oil inhalation to a

placebo group. Both VAS and Spielberger State-Trait Anxiety Inventory were used. The result showed that inhaled lavender essential oil was effective in reducing pain and anxiety during venipuncture procedures.

Amniocentesis is an important medical procedure that provides accurate diagnosis of intrapartum fetal abnormalities and contributes to planning optimal intrapartum management for pregnant women. However, because the procedure often induces pain and anxiety, some women refuse it. The present study aimed to identify a safe and effective method for pain and anxiety. Previous studies revealed that inhaled lavender and chamomile essential oils could reduce pain and anxiety from medical procedures without observed complications. Therefore, lavender and chamomile essential oils were selected as pain and anxiety reduction modalities in the present study.

This study demonstrated significant pain reduction with the inhalation of both lavender and chamomile essential oils when compared to the control group. Lavender exhibited statistically significant decreases in pain levels both during amniocentesis and 15 minutes after the procedure. Similarly, chamomile showed significant reduction in pain levels at 15 minutes after amniocentesis. In terms of anxiety reduction, lavender had significantly reduced anxiety levels 15 minutes after amniocentesis. Chamomile had significantly reduced anxiety 15 minutes and 30 minutes post procedure. When comparing chamomile and lavender directly, the present study found no statistically significant differences in their efficacy for pain or anxiety reduction at any of the observed times.

This study suggests that both lavender and chamomile essential oils had comparable effectiveness in reducing pain and anxiety associated with amniocentesis. Both lavender and chamomile essential oils demonstrated efficacy in reducing pain 15 minute after the procedure, and lavender but not chamomile reduce pain during the procedure. Both lavender and chamomile showed efficacy in anxiety reduction at 15 minutes after amniocentesis, and chamomile but not lavender continued to reduce anxiety 30 minutes post procedure.

The findings of the present study provide valuable insights into safe methods for pain and anxiety reduction during amniocentesis, with potential applications in clinical settings. A strength is that this study was a prospective randomized controlled trial, and the participants had similar demographic characteristics. A limitation is that it was a single-center study. Additionally, the study had a single-blinded approach, where the participants were aware of the essential oil they were inhaling. The assessment of pain and anxiety relied on subjective measures, which could have been influenced by individual experiences and perceptions of pain and anxiety. For future research, studying the efficacy of alternative essential oils during other medical procedures could offer a more comprehensive understanding of the options available for pain and anxiety reduction during medical procedures.

Conclusion

Aromatherapy effectively reduces pain and anxiety associated with amniocentesis. In the present study, both lavender and chamomile reduced pain at 15 minutes after the procedure, but only lavender has efficacy in pain reduction during the procedure. Both lavender and chamomile reduced anxiety 15 minutes after the procedure, but only chamomile continued to reduce anxiety 30 minutes post procedure. However, when comparing lavender and chamomile, there was no statistically significant difference in efficacy of pain or anxiety reduction.

What is already known on this topic?

Aromatherapy, using scents from essential oils has demonstrated efficacy in reducing pain and anxiety in various medical procedures. Therefore, it could be considered as a viable method for reducing pain and anxiety during amniocentesis.

What does this study add?

Both lavender and chamomile essential oil effectively reduce pain and anxiety associated with amniocentesis. Thus, both lavender and chamomile could be used as the options available for pain and anxiety reduction during amniocentesis procedures.

Conflicts of interest

The authors declare no conflict of interest.

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