ORIGINAL ARTICLE

Efficacy of Lavender Aroma Inhalation for Pain and Anxiety Relief during Endometrial Sampling in Women Aged at Least 35 Years Old with Abnormal Uterine Bleeding

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Objective: To evaluate the efficacy of lavender essential oil inhalation for pain and anxiety relief in the endometrial biopsy procedure.

Materials and Methods: This single-blinded randomized controlled trial was conducted at the gynecology outpatient clinic, Thammasat University Hospital, Thailand, between June 2024 and March 2025. Participants were women aged 35 years and older with abnormal uterine bleeding and equally randomized to receive either lavender essential oil, as the study group, or sterile water, as the control group. inhalation. Pain and anxiety were assessed using the visual analogue scale (VAS) and the visual facial anxiety scale (VFAS) at three time-points: anticipatory, during procedure, and 15 minutes post-procedure.

Results: One hundred forty women were recruited. The study group had significantly reduced pain during and 15 minutes after the procedure. Anticipatory severe pain and severe pain during the procedure of both groups were comparable. Post-procedural severe pain of the study group was significantly lower than control group (p=0.017). The study group had a significant reduction in anxiety scores 15 minutes post-procedure (p=0.036). Severe anxiety did not differ significantly between groups at anticipatory, during procedure, and 15 minutes post-procedure.

Conclusion: Lavender essential oil inhalation was effective in reducing pain during and after endometrial sampling, and alleviated anxiety following the procedure.

Keywords: Lavender essential oil; Pain; Anxiety; Endometrium biopsy

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Abnormal uterine bleeding (AUB) in women aged 35 years and older is a significant clinical concern. It may be a presenting symptom of various pathological conditions, including uterine fibroids, endometritis, endometrial hyperplasia, endometrial polyps, and endometrial carcinoma. Hysteroscopic-directed endometrial biopsy had been considered the clinical "gold standard" for a long time due to its high sensitivity and specificity[1]. However, hysteroscopy is invasive, requires anesthesia, and requires specialized equipment. In addition, hysteroscopy may also increase cost and patient burden. In recent years, office-based endometrial sampling techniques have become increasingly preferred as the first-line diagnostic approach for AUB. These procedures were simpler, faster, and more convenient than diagnostic hysteroscopy[2].

There are various types of aspirators, including high-pressure devices such as Karman cannula[3] and Vabra aspirator (VABRA®, Cooper Laboratories Inc., Wayne, NJ, USA)[4], and low-pressure devices such as Endocell (Wallach Endocell®, Cooper Surgical Inc., Trumbull, CT, USA) and Pipelle[5] (Pipelle®, CooperSurgical Inc., Trumbull, CT, USA). The advantages of low-pressure endometrial aspiration biopsy included avoidance of cervical dilation due to the small-diameter instruments, ease of insertion into the uterine cavity, reduced risk of uterine

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perforation, and no anesthesia requirement. Office-based endometrial sampling is becoming more widely used due to its simplicity, cost-effectiveness, and high patient acceptability. Pipelle achieves adequate sampling in more than 94% of cases and demonstrates high diagnostic accuracy, with a sensitivity of 94.1% and specificity of 100% for cancer detection in postmenopausal AUB[5].

Although aspiration-based endometrial sampling is associated with less pain than sharp curettage[6], endometrial biopsy is still frequently accompanied by procedural pain and anxiety, which may adversely affect patient comfort and tolerance of the procedure. Many studies have evaluated various agents for procedural pain relief, including lidocaine cervical spray[7,8], paracervical block[9], intrauterine lidocaine[10-12], and oral non-steroidal anti-inflammatory drugs (NSAIDs)[13].

Beyond pharmacological pain management, alternative pain relief strategies have been explored, particularly for patients with contraindications to NSAIDs or local anesthetics due to allergies or other medical concerns. Recent studies have demonstrated the efficacy of lavender essential oil inhalation in reducing pain during gynecologic procedures, including intrauterine device (IUD) insertion[14], intrauterine insemination (IUI)[15], dysmenorrhea relief[16], and reduction of acute pain and post-gynecologic operative pain[17]. Aromatherapy acts through olfactory stimulation that activates the limbic system. It modulates pain pathways and induces serotonin, endorphins, gamma-aminobutyric acid (GABA), and dopamine release. Aromatherapy also reduces sympathetic activity and increases parasympathetic tone. These mechanisms help alleviate pain perception and anxiety[18-20]. In addition to its analgesic effects, lavender essential oil has shown a reduction in anxiety associated with gynecologic procedures[14,15].

The present study aimed to investigate the effectiveness of lavender essential oil in alleviating pain and anxiety before, during, and after endometrial aspiration biopsy.

Materials and Methods

This prospective single-blinded randomized controlled trial was approved by the Ethics Committee, Faculty of Medicine, Thammasat University Hospital (TUH) on May 7, 2024 (MTU-EC-OB-1-040/67). It was registered in the Thai Clinical Trials Registry on May 22, 2024 (TCTR20240522002). The study was conducted at the Gynecology Outpatient Clinic, TUH, Pathum Thani, Thailand, between June 2024 and March 2025. Subjects were women aged 45 years or older with AUB. Those aged 35 years or older with AUB and unopposed estrogen risk factors (obesity or polycystic ovary syndrome) or persistent AUB were also included[21]. After individual counseling, the participants signed informed consent forms. Exclusion occurred in patients with underlying coagulopathy, taking medications that affect blood coagulation, pregnancy, pelvic inflammatory disease, cervical stenosis, olfactory dysfunction due to various causes, such as inflammation of the olfactory nerve, nasal obstruction, or sinusitis, patients with a history of lavender allergy, and those who do not consent to participate in the present study.

Demographic data, namely age, body mass index (BMI), level of education, income, underlying diseases, drug allergy, hormonal usage, vaginal delivery, and history of uterine curettage, were collected. Patients were randomly assigned to two groups using a computer-generated table of random numbers. Group allocations were concealed in sealed opaque envelopes. Nurses at the outpatient clinic would open the envelopes once they met the participants. The control group will receive cotton pads with sterile water, while the study group will receive pads with three drops of lavender essential oil (The Royal Project Foundation, Chiang Mai, Thailand). Participants inhaled the cotton pad soaked in either lavender essential oil or sterile water, which were sealed in identical pouches for 15 minutes before positioning for endometrial aspiration.

For the procedure, each patient was placed in the lithotomy position. The bivalve speculum and tenaculum were applied. Then, endometrial sampling was performed by using The Curette® (Bioteque, New Taipei City, Taiwan) connected to a 10 mL syringe for vacuum aspiration and rotation at 3, 6, 9, and 12 o'clock positions of the uterine cavity. During the procedure, participants might inhale either sterile water or lavender essential oil as frequently as desired. Assessment of pain severity level was evaluated by using a visual analogue scale (VAS)[22] recorded by the assisting nurse. The VAS score was ranked from 0 (no pain) to 10 (worst pain). The results were then categorized into mild pain (score of 0 to 4), moderate pain (5 to 6), or severe pain (7 to 10). Anxiety score was assessed using the visual facial anxiety scale (VFAS), a validated instrument demonstrated in previous studies by Cao et al.[23] and Yumul et al[24]. The VFAS score was ranked from 0 (no anxiety) to 10 (worst anxiety). The results were

also categorized as mild anxiety (score of 0 to 4), moderate anxiety (5 to 6), or severe anxiety (7 to 10).

Pain and anxiety scores were assessed at three time points: before the procedure (P0 for pain and A0 for anxiety), during endometrial sampling (P1 and A1), and 15 minutes after the procedure (P2 and A2). Side effects, including nausea, vomiting, dizziness, itching, and heavy vaginal bleeding, were also observed. All tissue samples were sent for pathological examination.

The sample size in the present study was calculated by a pilot study, using the median pain score from the study and control groups. Median pain score of the study and the control groups was 5.4 and 7.79, respectively. The standard deviation (SD) of the pain score of the control group was 4.16. The alpha and beta errors were set at 0.1 and 90%, respectively. The minimum required sample size was at least 63 participants per group. To account for potential dropouts or incomplete data, 10% of the calculated sample size (7 participants) was added. As a result, the final sample size was adjusted to 70 participants per group, yielding 140 participants. Data were analyzed using SPSS Statistics for Windows, version 17.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were presented as median and interquartile range, then compared between groups using the independent Wilcoxon rank sum test. Categorical variables were analyzed using the chi-square test. A p-value of less than 0.05 was considered statistically significant. Final analysis using multi-variable multi-level linear regression with random intercept and random slope.

Results

One hundred forty eligible participants were enrolled in the present study, 70 participants in each group. All participants successfully completed the endometrium sampling procedure without complication. None of the study group participants had adverse effects from inhaling lavender essential oil (Figure 1).

Comparison of demographic data (Table 1) revealed no significant differences between the control and intervention groups. The mean ages were 48.4 and 50 in the control and study group, respectively. The mean BMI of both groups were 27.9 and 26.7 in the control and study group, respectively. Approximately 45% of the control group experienced vaginal delivery, whereas the study group was 60%. Previous endometrial sampling or dilation and curettage were experienced by approximately 45% in the control group and 40% in the study group.

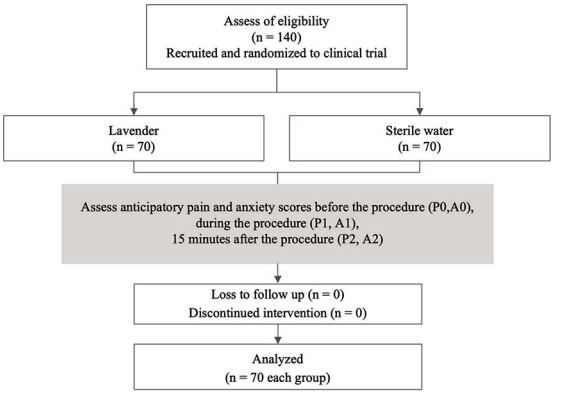

Figure 1. Flow chart of study.

Table 1. Demographic characters of participants of sterile water group (n=70) and lavender group (n=70)

	Sterile water	Lavender	p-value
Age (years); mean±SD	48.44±9.19	50.03±8.8	0.29
BMI (kg/m^2); mean±SD	27.9±6.03	26.7±5.2	0.21
Education: Bachelor or higher; n (%)	29 (41.4)	29 (41.4)	0.17
Incomes (Baht/month); n (%)			0.78
<30,000	36 (51.4)	35 (50.0)	
30,000 to 50,000	10 (14.3)	13 (18.6)	
>50,000	24 (34.3)	46 (32.9)	
No UD; n (%)	39 (55.7)	37 (52.9)	0.73
No hormonal use; n (%)	55 (78.6)	54 (77.1)	0.839
No history of OBGYN surgery; n (%)	36 (51.4)	31 (44.3)	0.398
History of ND; n (%)	31 (44.3)	41 (58.6)	0.091
History of EB; n (%)	17 (24.3)	15 (21.4)	0.687
History of D&C; n (%)	15 (21.4)	13 (18.6)	0.673

SD=standard deviation; BMI=body mass index; UD=underlying disease; OBGYN=Obstetrics and Gynecology; ND=normal delivery; EB=endometrium biopsy; D&C=dilation and curettage

Demographic characteristics of both groups were comparable, as shown in Table 1.

In Figure 2, the median VAS pain scores of the control group before the endometrial sampling procedure, during the procedure, and 15 minutes after the procedure were 7, 7.5, and 7, respectively. In contrast, the study group demonstrated lower median pain scores at the same time points: 6, 7, and 5, respectively. Lavender aromatherapy resulted in significantly lower pain scores both during the procedure (p=0.032) and 15 minutes afterward (p=0.004) compared to the control group.

The median VFAS anxiety scores of the control group at 15 minutes before the endometrial sampling procedure, during the procedure, and 15 minutes after the procedure were 7, 7, and 6, respectively, whereas 6, 7, and 5, respectively, in

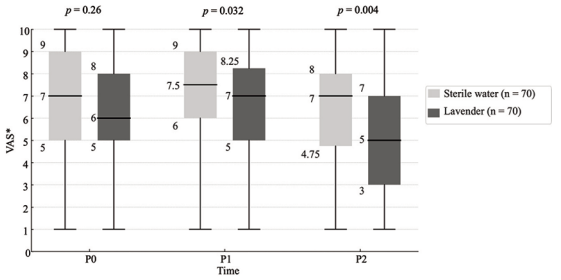

Figure 2. Comparison of pain scores (VAS) (n=140).

VAS=visual analogue scale; P0=anticipatory pain scores before procedure; P1=pain scores during the procedure; P2=pain scores 15 minutes after the procedure; Sterile water=inhaled cotton ball soaked with sterile water; Lavender=inhaled cotton ball soaked with lavender essential oil

* Median (interquartile range, IQR)

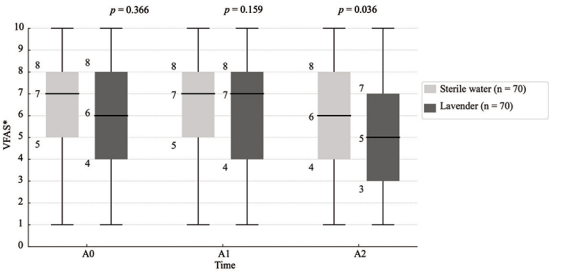

Figure 3. Comparison of anxiety scores (VFAS) (n=140).

VFAS=visual facial Anxiety scale; A0=anticipatory anxiety scores before procedure; A1=anxiety scores during the procedure; A2=anxiety scores 15 minutes after the procedure; Sterile water=inhaled cotton ball soaked with sterile water; Lavender=inhaled cotton ball soaked with lavender essential oil

* Median (interquartile range, IQR)

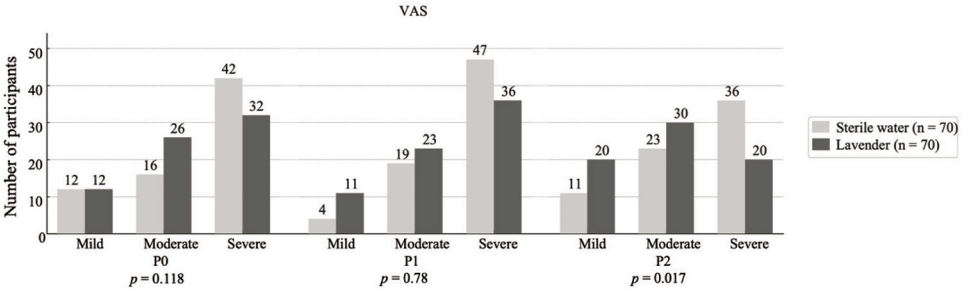

Figure 4. Comparison of categorized pain scores (n=140).

VAS=visual analogue scale; P0=anticipatory pain scores before procedure; P1=pain scores during the procedure; P2=pain scores 15 minutes after the procedure; Sterile water=inhaled cotton ball soaked with sterile water; Lavender=inhaled cotton ball soaked with lavender essential oil

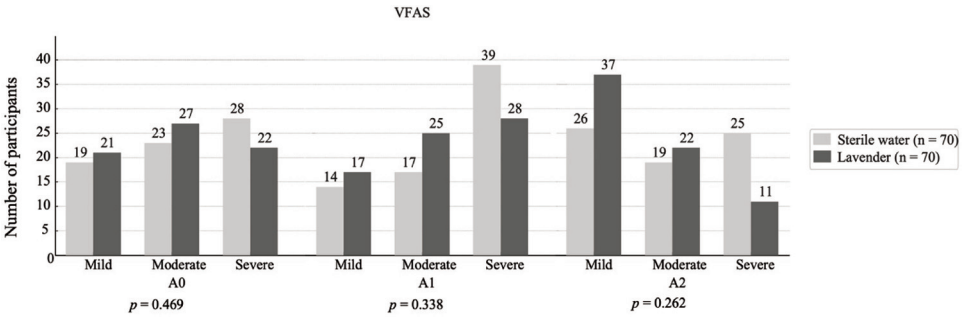

Figure 5. Comparison of categorized anxiety scores (n=140).

VFAS=visual facial anxiety scale; A0=anticipatory anxiety scores before procedure; A1=anxiety scores during the procedure; A2=anxiety scores 15 minutes after the procedure; Sterile water=inhaled cotton ball soaked with sterile water; Lavender=inhaled cotton ball soaked with lavender essential oil

the study group. The anxiety score was significantly different only 15 minutes after the procedure (p=0.036) (Figure 3).

Intensity of pain was categorized into three groups. The proportion of participants anticipating severe pain prior to the procedure were not significantly different between the lavender and control groups (45.7% versus 60%, p=0.12). In contrast, a lower percentage of participants in the study group that experienced severe pain after the procedure compared to the control group was significantly different (28.6% versus 51.4%, p=0.017) (Figure 4).

There were no statistically significant differences in anxiety score intensity after categorization into three groups (Figure 5).

Discussion

Pain and anxiety are common during outpatient gynecologic procedures and may affect patient comfort and procedural tolerance. Various pharmacological approaches had been explored for pain reduction in endometrial biopsy. Intrauterine lidocaine has consistently demonstrated efficacy in alleviating pain. However, previous studies required instillation into the uterine cavity with a waiting period of three minutes before initiating the biopsy. Trolice et al.[11] and Hui et al.[25] both reported significant pain reduction during biopsy, presumably through anesthetic effects on endometrial nerve endings supplied by Frankenhauser's plexus (S2 to S4) and the ovarian nerve plexus to the uterine fundus. Similarly, Benchahong et al.[10] found that intrauterine lidocaine significantly reduced pain during biopsy, as well as at 15 minutes and even two hours post-procedure. Guney et al.[12] demonstrated that the combination of intrauterine lidocaine and buccal misoprostol resulted in significant reductions in pain during and immediately after biopsy, although mild adverse effects, including lower abdominal discomfort and uterine cramping, were observed.

Other local anesthetic strategies have also been evaluated. Both cervical lidocaine spray[8] and paracervical block[9] had shown to be effective in reducing pain during endometrial biopsy. Spray is less invasive and associated with lower risks of complications, including intravascular injection, bleeding, and infection. Olad-Saheb-Madarek et al.[26] further demonstrated that combining intrauterine lidocaine with cervical spray significantly reduced pain both during and 15 minutes after biopsy. In contrast, oral NSAIDs such as etoricoxib require administration 30 to 60 minutes prior to the procedure to achieve therapeutic effect[13]. However, this is not suitable for the outpatient settings. Moreover, their analgesic effect was confined to 30 minutes post-procedure and did not reduce pain during the biopsy.

The accumulated evidence demonstrated that although pharmacologic interventions may alleviate pain during certain phases of endometrial biopsy, their application was limited by delayed onset, short duration, the need for invasive administration, drug allergies, and potential adverse effects. Consequently, increasing attention has turned to non-pharmacologic approaches. Systematic reviews consistently supported the efficacy of aromatherapy in alleviating pain and anxiety in both clinical and preclinical studies[18,19,27-29]. Thus, aromatherapy offered a simple and non-invasive option for pain and anxiety management.

Among various essential oils, lavender was the most extensively studied. Lavender was traditionally used for calming and anxiety relief and increasingly supported by scientific evidence[30,31]. In previous studies about the efficacy of aromatherapy in pain and anxiety, lavender essential oil was found to significantly reduce acute pain and post gynecologic operative pain[17], dysmenorrhea[16], postoperative caesarean section pain and anxiety[32], pain and anxiety in gynecologic examination[33].

The findings from the present study indicated that lavender aromatherapy significantly reduced pain score during and after the endometrial biopsy. In addition, the number of women reporting severe pain after the procedure was lower in the lavender group compared with the control group. These results contrast with the trial by Shahnazi et al.[14], which evaluated inhaled lavender aromatherapy during IUD insertion and found no difference in pain scores compared with placebo. The discrepancy may be explained by procedural differences: endometrial biopsy induces sustained uterine cramping due to activation of C-type nerve fibers, whereas IUD insertion typically causes only brief discomfort without a prolonged cramping phase, thus diminishing the potential benefit of aromatherapy.

Previous studies on endometrial biopsy had primarily focused on pain reduction, with no evaluations addressing its impact on anxiety. The present study demonstrated that lavender aromatherapy significantly reduced anxiety after the procedure, whereas no significant side effects were observed during the endometrial biopsy. The result indicated that its anxiolytic benefits are associated with post-procedural recovery rather than acute procedural stress. These findings are consistent with earlier studies that demonstrated anxiolytic benefits of lavender aromatherapy in gynecologic procedures such as IUD[14] insertion and IUI[15].

To the authors' knowledge, this is the first study to demonstrate that lavender aromatherapy significantly reduces both pain and anxiety in women undergoing endometrial biopsy. With no adverse effects observed, lavender aromatherapy is a safe, inexpensive, and practical adjunct for outpatient gynecologic procedures in reducing both pain and anxiety, particularly when pharmacologic options are limited or undesirable.

Limitation

Nevertheless, this study had limitations. First,

pain and anxiety assessments were based on subjective self-reports using VAS and VFAS, which may be influenced by individual pain and anxiety thresholds and psychological factors. Second, blinding may not have been fully effective, as participants familiar with the scent of lavender could potentially guess their group allocation, introducing bias.

Conclusion

This randomized single-blind controlled trial demonstrated that lavender essential oil inhalation effectively reduced pain during and after endometrial sampling, as well as post-procedural anxiety.

What is already known about this topic?

Previous studies had evaluated pharmacologic or invasive methods to alleviate pain during endometrial biopsy. However, these approaches are limited by adverse effects and the risk of drug-related complications.

What does this study add?

This was the first study that evaluated non-invasive and non-pharmacological intervention to reduce pain and anxiety during endometrial biopsy. Lavender aroma inhalation demonstrates significantly reduced both procedural and post-procedural pain as well as post-procedural anxiety. Lavender aromatherapy thus represents a simple, safe, and inexpensive non-invasive adjunct to improve patient comfort in outpatient gynecologic practice.

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Authors' contributions

NP contributed to the study design, data collection, interpretation of the results, preparation of the manuscript, and approval of the final version for publication. AC and KP contributed to data analysis and interpretation. DB contributed to the statistical analysis. SB and DP contributed to the critical revision of the manuscript. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

Ethics approval and consent to participate

This study received ethical approval from the Ethics Committee of the Faculty of Medicine, Thammasat University Hospital (TUH) on May 7, 2024 (MTU-EC-OB-1-040/67). Written informed consent was obtained from all participants prior to enrollment.

Clinical trial registration

This study was registered with the Thai Clinical Trials Registry (TCTR20240522002) on May 22, 2024.

Use of artificial intelligence

This study was conducted and reported without the use of artificial intelligence (AI) tools.

Conflicts of interest

This manuscript is not under consideration by another journal, and the final manuscript has been seen and approved by all authors. The authors declare that there are no conflicts of interest regarding the publication of this article.

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