Original Article

Eur J Breast Health 2025; 21(3): 190-196
DOI: 10.4274/ejbh.galenos.2025.2025-2-11

The Effect of Aromatherapy on Pain and Anxiety Levels Before Breast Biopsy: A Randomized Controlled Trial

Ezgi Hancı[1], Yasemin Uslu[2], Erkin Arıbal[3]

[1]Acıbadem Mehmet Ali Aydınlar University Health Sciences Institute, İstanbul, Türkiye
[2]İstanbul University Faculty of Nursing, Surgical Nursing Department, İstanbul, Türkiye
[3]Acıbadem Mehmet Ali Aydınlar University Faculty of Medicine, Department of Radiology, İstanbul, Türkiye

ABSTRACT

Objective: Aromatherapy is widely used in the management of symptoms caused by interventional procedures. This randomized controlled trial evaluated the effectiveness of lavender and lavender-peppermint aromatherapy before breast biopsy for reducing women's pain and anxiety.

Materials and Methods: This trial was conducted in the breast outpatient clinic of a university hospital in İstanbul between July 2021 and March 2023. Patients were randomly assigned to one of two intervention groups; lavender or lavender-peppermint or the control group. Twenty minutes before the breast biopsy, a small pad impregnated with lavender or lavender-peppermint essential oil was attached to each patient at shoulder level, allowing for inhalation. The patients' anxiety and pain levels were assessed before and after the biopsy procedure using the state anxiety inventory and visual analogue scale, respectively.

Results: Study population was 135 patients, equally divided between lavender, lavender-peppermint or control groups (each n = 45). The mean age of the patients was 46.30±10.31 years, 76% were married, 65.9% were employed, and 64.4% underwent thick-needle biopsy. After the biopsy, reported anxiety and pain levels had decreased significantly more in the aromatherapy groups compared to the control group (p<0.05). However, no significant difference was found between the lavender and lavender-peppermint groups in terms of anxiety and pain reduction (p>0.05). Anxiety and pain levels were positively correlated (r = 0.406; p<0.001).

Conclusion: The use of lavender and lavender-peppermint essential oil via inhalation before breast biopsy was effective in reducing reported anxiety and pain levels. Implementing lavender and lavender-peppermint essential oil inhalation before interventional procedures may offer a simple and cost-effective approach to improving patient outcomes.

Keywords: Anxiety; aromatherapy; breast biopsy; breast cancer; pain management

Cite this article as: Hancı E, Uslu Y, Arıbal E. The effect of aromatherapy on pain and anxiety levels before breast biopsy: a randomized controlled trial. Eur J Breast Health. [Epub Ahead of Print].

Key Points

- Aromatherapy with lavender and lavender-peppermint essential oil impregnated into an absorbent pad and worn on the shoulder for 20 minutes before breast biopsy reduced anxiety and pain levels in women.
- A positive correlation was found between pain and state anxiety levels, indicating that managing one may help alleviate the other.
- Aromatherapy provided a simple, cost-effective, and non-invasive nursing intervention that improved reported patient comfort before an interventional procedure.

Introduction

Breast cancer is the most common cancer in women, accounting for 30% of cases. According to GLOBOCAN 2020, its incidence was 47.8 per 100,000 women, representing 24.5% of all new cancer diagnoses (1). Early diagnosis significantly improves treatment outcomes (2), and breast biopsy is a key diagnostic method (3). However, this procedure can cause anxiety, stress, and pain, with fear of both the procedure and a potential cancer diagnosis contributing to emotional distress (4). Aromatherapy involves the use of essential oils extracted from plants for therapeutic purposes (5, 6). While the evidence on its benefits is mixed, no adverse effects have been reported (7, 8). Deng et al. (9) found that aromatherapy significantly reduced pain, anxiety, and interleukin-6 levels compared to standard care. In women with breast cancer, essential oils, including lavender, have been associated with reduced anxiety, stress (10, 11), pain (12), and other physical and psychological symptoms (13).

Received: 25.02.2025
Accepted: 14.03.2025
Epub: 20.05.2025

Corresponding Author:
Yasemin Uslu, Assoc. Prof., PhD; yasemin.uslu@istanbul.edu.tr

In the literature, aromatherapy is frequently used in cancer and breast cancer patients for symptom management, particularly in alleviating anxiety and pain (6, 14). However, fewer studies have examined the effects of aromatherapy in individuals undergoing diagnostic procedures, such as breast biopsy. Some research has suggested that aromatherapy may be beneficial in reducing procedural anxiety and pain in similar interventional settings, such as diagnostic imaging or minimally invasive procedures. Expanding on this area of research, the present study was conducted during the breast cancer diagnostic process and compared different aromatherapy oils with a control group.

In addition, while lavender, rose, and orange essential oils are commonly studied for stress and anxiety in clinical settings (6), this study uniquely compared lavender-peppermint aromatherapy against lavender alone to explore potential differences in effectiveness. The rationale for choosing this combination was based on the complementary properties of the two oils. By combining peppermint with lavender, this study aimed to investigate whether a synergistic effect could be achieved in procedural anxiety and pain management, as is frequently applied in integrative aromatherapy practices. A peppermint-only group was not included, as its independent efficacy in reducing procedural anxiety and pain has not been consistently supported in prior research. The rationale for this study design was to obtain higher-quality evidence on the role of aromatherapy in procedural anxiety and pain management. Since anxiety and pain are closely interrelated, both parameters were assessed separately using validated measurement tools to ensure an objective evaluation.

Materials and Methods

Design and Aim

A randomized controlled trial was conducted to compare the effectiveness of lavender or lavender-peppermint aromatherapy in reducing anxiety and pain before breast biopsy. The study was registered in a clinical trial registry (NCT: 05276505) and complied with the CONSORT guidelines.

Research Hypotheses

H1: Applying lavender aromatherapy prior to breast biopsy reduces anxiety and pain.

H2: Applying lavender-peppermint aromatherapy prior to breast biopsy reduces anxiety and pain.

H3: There is a difference in the effectiveness of lavender and lavender-peppermint aromatherapy oils in reducing anxiety and pain before breast biopsy.

Population and Sample

The study was conducted in the breast outpatient clinic of a hospital in İstanbul between July 2021 and March 2023. Sample size was determined by performing power analysis in the G*Power (v3.1.9) program. Trambert et al. (11) calculated an effect size of d = 0.603. Based on this estimated effect size and an alpha level of 0.05, at least 45 patients in each group (total of 135 patients) were required to achieve 80% power (1-β).

Therefore, a total of 135 patients, two-thirds (n = 90) of whom were in the experimental group and the remining third (n = 45) in the control group, were included. Adult female patients >18 years and scheduled for breast biopsy (vacuum biopsy, thick-needle biopsy, magnetic resonance imaging-guided biopsy) were included in the study. Excludion factors included pregnancy or breastfeeding, lavender allergy, impaired sense of smell, difficulty breathing or active wheezing, history of asthma, epilepsy, or seizures, a diagnosed psychiatric disorder or migraines, and any cognitive, verbal, or hearing impairment that could affect communication. At the end of the study, the sample effect size was calculated. Post-hoc analysis showed effect sizes (Cohen's d) of 0.924 (98% power) between the lavender and control groups, 1.139 (99% power) between the lavender-peppermint and control groups, and 0.176 (12% power) between the two aromatherapy groups.

Randomization

Randomization was done using an online randomizer (https://www.randomlists.com/random-letters). Patients were randomly assigned to the experimental and control groups according to the number sequence generated by the program.

Data Collection Process

The breast clinic in which the study was conducted is staffed by three physicians and two nurses. Thick-needle and vacuum biopsy procedures are performed most often, with an average of two patients biopsied daily. The biopsy method may vary depending on institutional functioning, and patient and physician preferences. After the physician explains the steps of the biopsy procedure in the breast clinic, the patient's consent is obtained. Patients are taken to the waiting room while preparations are made. Biopsy procedures take approximately 15–20 minutes.

For all participants in the present study, pre-biopsy pain and anxiety were assessed in the waiting room, before starting the intervention in the aromatherapy groups. The control group received no intervention before the biopsy procedure. Assessments of post-biopsy pain and anxiety were performed immediately after procedure in the biopsy room. The study design is shown in Figure 1.

Lavender or lavender-peppermint aromatherapy absorbent pad intervention: Twenty minutes before the breast biopsy, a small (approximately 2.5×1.2 cm) rectangular absorbent pad impregnated with 2 mL of lavender or lavender-peppermint essential oil was attached to each patient at shoulder level. All patients wore the aromatherapy absorbent pads for exactly 20 minutes under the supervision of the researcher, and the pads were removed immediately before the breast biopsy procedure began. The exposure time was standardized for all participants to ensure consistency. After the procedure, the patients' anxiety and pain levels were reassessed. To prevent the aromas from mixing in the waiting room atmosphere, the procedures were performed in different biopsy rooms for the two groups. No patient reported any severe adverse events.

Lavender essential oil (Lavandulae aetheroleum): Lavender essential oil is reported to have antibacterial, antiviral, antifungal, and anti-inflammatory effects (15), as well as analgesic and anti-edema effects (16). It is used for pain relief and relaxation (17). The active ingredient in lavender oil that reduces pain is linalool. Lavender oil is also effective in regulating emotional responses, heart rate, blood pressure, and respiration (5).

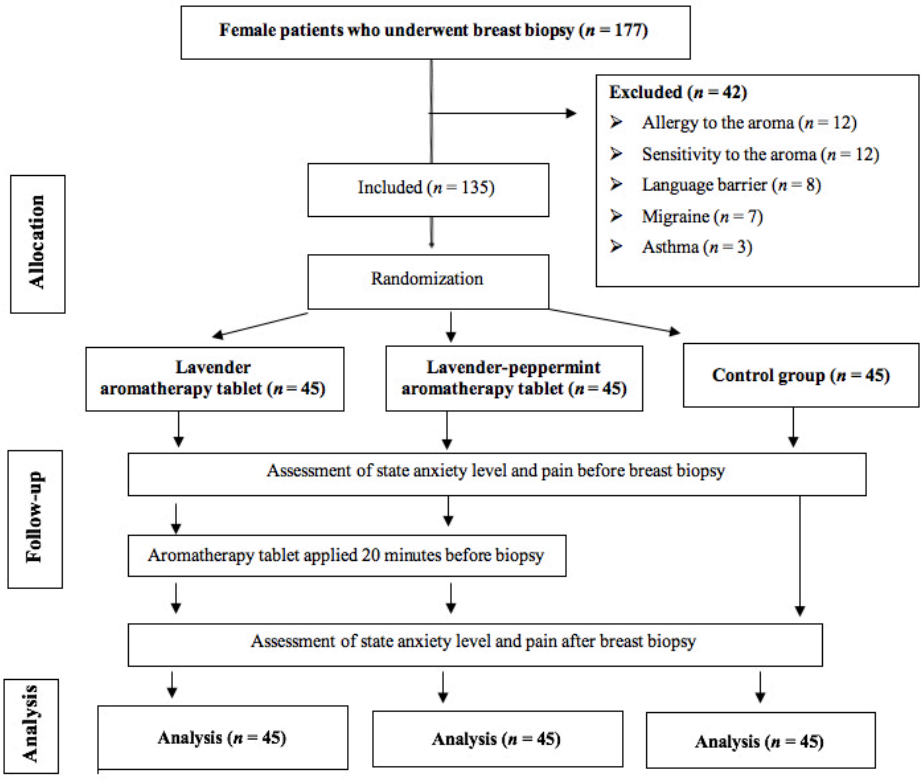

Figure 1. CONSORT flow chart

Peppermint essential oil (Menthae piperitae aetheroleum): The pharmacological effect of peppermint essential oil is due to the menthol it contains (18). It is reported to have antipruritic, astringent, and antiseptic effects. It is a powerful supporter of the digestive and respiratory systems. Peppermint essential oil is effective against physical and mental fatigue and increases physical and mental capacity (19).

Data Collection Tools

The study data were collected using a personal information form, the state anxiety inventory, and visual analog scale. The personal information form was created by the researchers and included questions about the participants' demographic characteristics, such as age, comorbity, and marriage status and their biopsy procedure, including details of biopsy type and biopsy history.

State anxiety inventory: The scale was developed by Spielberg et al. (21) in 1970 and adapted to Turkish by Öner and Le Compte (20). For each item, the patient selects "not at all" (1), "a little" (2), "somewhat" (3), or "very much" (4) according to how they feel at the present moment. Items expressing positive emotions (e.g., "I feel calm") are reverse-scored. The total score ranges from 20 to 80. A high scale score is directly proportional to a high anxiety level. A score of 20 points can be interpreted as no anxiety, 21–39 points as mild anxiety, 40–59 points as moderate anxiety, 60–79 points as severe anxiety, and 80 points as extreme anxiety, equivalent to panic (20, 21).

Visual analog scale: The patient rates their pain level on a 10-cm line marked at 1-cm intervals from 0 ("no pain") on one end to 10 ("worst pain") on the other. Scores of 1–2 describe slight pain, 3–4 describe mild pain, 5–6 describe moderate pain, and 7 or higher describe severe pain (22).

Ethical Considerations

Acıbadem University and Acıbadem Healthcare Organizations Medical Research Ethics Committee approved the study (decision number: 2021-14/18, date: 29.07.2021) and written informed consent from all participants were obtained. The study was supported by the Acıbadem University Scientific Research Projects Coordination Unit (project number: 2022/07-19).

Statistical Analysis

SPSS, version 25.0 (IBM Corp., Armonk, NY, USA) was used for statistical analyses of the study data. For statistical analysis of continuous variables, the Kolmogorov-Smirnov test was used to test the normality of score distributions. In addition to descriptive statistical methods, comparisons of quantitative data between groups were made with one-way analysis of variance or its non-parametric equivalent, the Kruskal-Wallis H test, followed by post-hoc Bonferroni test. Qualitative comparisons between groups were made using Pearson or Fisher chi-square tests. Relationships between continuous variables were analyzed using Spearman's correlation test. Differences in repeated measures were evaluated using Friedman's test for within-group comparisons and Wilcoxon's test for comparisons between two groups. Results were evaluated within 95% confidence intervals and significance was accepted at $p<0.05$.

Results

A total of 135 female patients who underwent breast biopsy were recruited for the study. The mean age of the participants was 46.30±10.31 years; 76% were married, 70.4% had children, 65.9% were actively working, and 83.3% had a university degree or higher level of education. Ultrasound-guided, thick-needle biopsy was

performed in 64.4% of the patients, while the remaining 35.6% underwent vacuum-assisted biopsy. Additionally, 32.6% of the participants reported having at least one chronic comorbidity. The demographic and clinical characteristics of the patients are presented in Table 1. The only significant difference between the groups was observed in terms of biopsy type (p = 0.027).

There were no significant differences in pre-biopsy state anxiety scores among the groups (p>0.05). However, post-biopsy anxiety levels were significantly higher in the control group compared to the lavender-peppermint group, with no significant difference between the control and lavender groups (p = 0.039). Bonferroni-adjusted post-hoc analysis confirmed that this difference was between the lavender-peppermint group and the control group (p = 0.032; d = 0.527), while no significant difference was detected between the lavender and control groups (p>0.05). Effect size analysis indicated large effects for both aromatherapy interventions (Cohen's d = 1.098 for the lavender group and d = 1.302 for the lavender-peppermint group) and a moderate effect for the control group (d = 0.380). When comparing the amount of reduction in state anxiety scores between groups, both the lavender (p = 0.001, d = 0.924) and lavender-peppermint groups (p<0.001, d = 1.139) exhibited significantly greater decreases than the control group, with no statistically significant difference observed between the two aromatherapy groups (p>0.05) (Table 2).

Similarly, no significant difference was found in pain levels between the groups before the biopsy (p>0.05). Post-biopsy assessments, however, revealed a significant difference in pain scores among the groups (p = 0.034). The Bonferroni-adjusted post-hoc analysis showed that this difference was between the lavender-peppermint group and the control group (p = 0.028; d = 0.646), while no significant difference was noted between the lavender and control groups (p>0.05). Effect size analysis revealed large effects for both aromatherapy interventions (Cohen's d = 1.004 for the lavender group and d = 1.316 for the lavender-peppermint group) and a moderate effect for the control group (d=0.475). In terms of the amount of reduction in pain scores, both the lavender (p = 0.001, d = 0.823) and lavender-peppermint groups (p<0.001, d = 1.112) demonstrated significantly greater reductions compared to the control group, with no significant difference found between the two intervention groups (p>0.05) (Table 3).

Table 1. Distribution of the patients' demographic and descriptive characteristics

	Total (n = 135)	**Lavender group (n = 45)**	**Lavender-peppermint group (n = 45)**	**Control group (n = 45)**		
Variable	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**Test value**	***p*-value**
Age (year), mean ± SD	46.30±10.31	45.22±11.22	45.27±9.41	48.42±10.10	2.896[a]	0.235
Marital status					0.573[b]	0.751
Married	103 (76.3)	36 (80.0)	34 (75.6)	33 (73.3)		
Single	32 (23.7)	9 (20.0)	11 (24.4)	12 (26.7)		
Children					0.497[b]	0.780
Yes	95 (70.4)	33 (73.3)	30 (66.7)	32 (71.1)		
No	40 (29.6)	12 (26.7)	15 (33.3)	13 (28.9)		
Actively employed					0.857[b]	0.651
Yes	89 (65.9)	32 (71.1)	28 (62.2)	29 (64.4)		
No	46 (34.1)	13 (28.9)	17 (37.8)	16 (35.6)		
Education level					3.820[c]	0.437
Elementary school	6 (4.4)	3 (6.7)	1 (2.2)	2 (4.4)		
Middle school	17 (12.6)	6 (13.3)	3 (6.7)	8 (17.8)		
University or higher	112 (83.3)	36 (80.0)	41 (91.1)	35 (77.8)		
Biopsy type					7.565[b]	0.023*
Vacuum biopsy	48 (35.6)	11 (24.4)	14 (31.1)	23 (51.1)		
Thick-needle biopsy	87 (64.4)	34 (75.6)	31 (68.9)	22 (48.9)		
Chronic disease					0.067[b]	0.967
Yes	44 (32.6)	15 (33.3)	15 (33.3)	14 (31.1)		
No	91 (67.4)	30 (66.7)	30 (66.7)	31 (68.9)		
Biopsy history					0.084[b]	0.959
Yes	31 (23.0)	10 (22.2)	11 (24.4)	10 (22.2)		
No	104 (77.0)	35 (77.8)	34 (75.6)	35 (77.8)		

[a]: Mann-Whitney test; [b]: Pearson's chi-square test; [c]: Fisher's exact test; SD: Standard deviation

Table 2. Patients' state anxiety levels before and after biopsy

	State anxiety level					
	Pre-biopsy	Post-biopsy	Difference			
Research groups	**Mean ± SD**	**Mean ± SD**	**Mean (95% CI)**	**Test value**	***p*-value**	***d***
Lavender group 1	50.44±8.67	39.67±9.41	-10.78 (-13.73; -7.83)	-5.485[b]	<0.001*	1.098
Lavender-peppermint group 2	49.42±8.95	36.93±11.67	-12.49 (-15.37; -9.61)	-5.442[b]	<0.001*	1.302
Control group 3	46.04±10.84	43.27±12.36	-2.78 (-4.97; -0.58)	-2.882[b]	0.004*	0.380
Test value	4.343[a]	6.503[a]	26.006[a]			
***p*-value**	0.114	0.039*	<0.001*			
Subgroup	***p*-value/[d]**	***p*-value/[d]**	***p*-value/[d]**			
Group 1 *vs.* group 2	N/A	0.526[c]/0.258	0.682[c]/0.176			
Group 1 *vs.* group 3	N/A	0.698[c]/0.328	0.001[c*]/0.924			
Group 2 *vs.* group 3	N/A	0.032[c*]/0.527	<0.001[c*]/1.139			

*p<0.05; [a]: Kruskal-Wallis H test; [b]: Wilcoxon signed-rank test; [c]: Bonferroni test; SD: Standard deviation; CI: Confidence interval; N/A: Not available; [d]: Cohen's effect size

Table 3. Patients' pain levels before and after breast biopsy

	Pain level					
	Pre-biopsy	Post-biopsy	Difference			
Research groups	**Mean ± SD**	**Mean ± SD**	**Mean (95% CI)**	**Test value**	***p*-value**	***d***
Lavender group 1	6.09±1.87	3.71±2.13	-2.38 (-3.09; -1.67)	-5.349[b]	<0.001*	1.004
Lavender-peppermint group 2	6.00±1.75	3.20±1.89	-2.80 (-3.44; -2.16)	-5.535[b]	<0.001*	1.316
Control group 3	5.40±2.40	4.67±2.59	-0.73 (-1.20; -0.27)	-2.773[b]	0.006*	0.475
Test value	4.366[a]	6.789[a]	24.855[a]			
***p*-value**	0.113	0.034*	<0.001*			
Subgroup	***p*-value/[d]**	***p*-value/[d]**	***p*-value/[d]**			
Group 1 *vs.* group 2	N/A	0.768[c]/0.254	0.561[c]/0.188			
Group 1 *vs.* group 3	N/A	0.430[c]/0.403	0.001[c*]/0.823			
Group 2 *vs.* group 3	N/A	0.028[c*]/0.646	<0.001[c*]/1.112			

*p<0.05; [a]: Kruskal-Wallis H test; [b]: Wilcoxon signed-rank test; [c]: Bonferroni test; SD: Standard deviation; CI: Confidence interval; N/A: Not available; [d]: Cohen's effect size

Discussion and Conclusion

This study was conducted to determine the effect of two different aromatherapy essential oils before breast biopsy on patients' pain and anxiety levels. The results showed that anxiety decreased more in patients who received aromatherapy compared to those who received standard care, with a significant reduction seen with lavender-peppermint aromatherapy. We believe this combination might be more effective because of the mental relaxation induced by the active ingredient in peppermint essential oil in addition to lavender.

Undergoing a biopsy is a stressful experience, and all patients in our study had moderate anxiety before the procedure, which decreased afterward. The invasive nature of the biopsy and its role in cancer diagnosis may heighten anxiety, while completing the procedure may bring relief. Previous studies have shown that aromatherapy can reduce anxiety in various medical settings, including breast biopsy and imaging (11, 23). While a previous study found no significant effects of aromatherapy on perioperative anxiety and pain (24), our findings suggest that the use of some aromatherapy before interventional procedures may enhance the quality of care. This discrepancy may be due to differences in study design, the type and concentration of essential oils used as the only significant differences in this study were between the controls and the patients exposed to essential oils containing peppermint, the mode of administration, or variations in patient populations.

Biopsy procedures are also associated with pain. In this study, the participants reported moderate levels of pain before the biopsy. This may be related to increased pain sensitivity resulting from pre-biopsy

anxiety. However, considering that these patients were women at high risk for breast cancer and were in the process of diagnosis, their pain may also have been due to the presence of a mass, which is one of the symptoms of breast cancer. Participants in all three groups reported lower pain after the biopsy, but pain levels clinical and statistical decreased more in the aromatherapy groups with a significant difference again between the group exposed to peppermint and the controls. A similar study suggested that peppermint aromatherapy reduced pain and anxiety associated with intravenous catheterization (12). İlter et al. (25) also observed that orange, chamomile, and lavender inhaler aromatherapy reduced procedural pain and improved cooperation during port catheter insertion. In another study, bitter marjoram aromatherapy was reported to be an effective method of pain control (26).

There was a significant relationship between the anxiety and pain levels in this study. As suggested earlier, increased anxiety experienced by patients may increase their perception of pain. Previous studies have also demonstrated that anxiety and pain are positively associated in invasive procedures and that anxiety increases pain (27-29).

The use of aromatherapy absorbent pads prior invasive procedures offers a simple, cost-effective, and uncomplicated nursing intervention for reducing patient anxiety and pain. Although no statistically significant difference was found between the lavender and lavender-peppermint groups, clinical differences were observed. Our findings indicate that both lavender and lavender-peppermint essential oils may contribute to anxiety and pain reduction before breast biopsy but the only significant difference was observed for women exposed to peppermint essential oils compared to controls. Given the potential benefits, clinics may consider offering aromatherapy options to women based on their preferences if no contraindications exist.

Future studies should focus on conducting multicenter trials with larger and more diverse samples, including different patient groups. Furthermore, given the differences observed in the present study between lavender only or lavender plus peppermint essential oils, more research is needed to compare the effectiveness of various flavors of aromatherapy oils and the administration routes that result in optimal patient experiences. Finally, future studies should consider integrating qualitative patient experiences with fully quantitative findings.

Study Limitations

This randomized controlled study ensured comparable demographic variables across groups, with all interventions performed by the same researcher. Objective semi-quantitative methods were used for pre- and post-intervention assessments. However, the study's single-center design limits generalizability, and the high educational level of patients in a private health center may have influenced stress levels. In addition, anxiety and pain were measured based on patient self-perception. Furthermore, while the combination of lavender and peppermint oils was selected for their complementary properties, the absence of a peppermint-only group limits the ability to evaluate the independent effect of peppermint aromatherapy.

Ethics

Ethics Committee Approval: Acıbadem University and Acıbadem Healthcare Organizations Medical Research Ethics Committee approved the study (decision number: 2021-14/18, date: 29.07.2021).

Informed Consent: Informed consent was obtained from all participants.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.A.; Concept: E.H., Y.U., E.A.; Design: E.H., E.A.; Data Collection or Processing: E.H., Y.U., E.A.; Analysis or Interpretation: E.H., Y.U.; Literature Search: E.H., Y.U., E.A.; Writing: E.H., Y.U., E.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The study was supported by the Acıbadem University Scientific Research Projects Coordination Unit (project number: 2022/07-19).

References

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018;68:394-424. Erratum in: CA Cancer J Clin. 2020; 70: 313. (PMID: 30207593) [Crossref]
2. Slanetz PJ. MRI of the breast and emerging technologies. Last Access: May. 2020. [Crossref]
3. Gagliardi AR, Honein-AbouHaidar G, Stuart-McEwan T, Smylie J, Arnaout A, Seely J, et al. How do the characteristics of breast cancer diagnostic assessment programmes influence service delivery: a mixed methods study. Eur J Cancer Care (Engl). 2018; 27: e12727. (PMID: 28639355) [Crossref]
4. Burk L, Wehner D, Soo MS. Dreams prior to biopsy for suspected breast cancer: a preliminary survey. Explore (NY). 2020;16:407-409. (PMID: 32268982) [Crossref]
5. Farrar AJ, Farrar FC. Clinical aromatherapy. Nurs Clin North Am. 2020; 55: 489-504. (PMID: 33131627) [Crossref]
6. Keyhanmehr AS, Kolouri S, Heydarirad G, Mofid B, Mosavat SH. Aromatherapy for the management of cancer complications: a narrative review. Complement Ther Clin Pract. 2018; 31: 175-180. (PMID: 29705452) [Crossref]
7. Jo HG, Lee D. East Asian herbal medicine for cancer pain: a protocol for systematic review and meta-analysis with using association rule analysis to identify core herb pattern. Medicine (Baltimore). 2021; 100: e27699. (PMID: 34766572) [Crossref]
8. Lee SM, Choi HC, Hyun MK. An overview of systematic reviews: complementary therapies for cancer patients. Integr Cancer Ther. 2019; 18: 1534735419890029. (PMID: 31876212) [Crossref]
9. Deng C, Xie Y, Liu Y, Li Y, Xiao Y. Aromatherapy plus music therapy improve pain intensity and anxiety scores in patients with breast cancer during perioperative periods: a randomized controlled trial. Clin Breast Cancer. 2022; 22: 115-120. (PMID: 34134947) [Crossref]
10. Beyliklioğlu A, Arslan S. Effect of lavender oil on the anxiety of patients before breast surgery. J Perianesth Nurs. 2019; 34: 587-593. (PMID: 30660371) [Crossref]
11. Trambert R, Kowalski MO, Wu B, Mehta N, Friedman P. A randomized controlled trial provides evidence to support aromatherapy to minimize anxiety in women undergoing breast biopsy. Worldviews Evid Based Nurs. 2017; 14: 394-402. (PMID: 28395396) [Crossref]
12. Akbari F, Rezaei M, Khatony A. Effect of peppermint essence on the pain and anxiety caused by intravenous catheterization in cardiac patients: a randomized controlled trial. J Pain Res. 2019; 12: 2933-2939. (PMID: 31695482) [Crossref]
13. Farahani MA, Afsargharehbagh R, Marandi F, Moradi M, Hashemi SM, Moghadam MP, et al. Effect of aromatherapy on cancer complications: a systematic review. Complement Ther Med. 2019; 47: 102169. (PMID: 31779991) [Crossref]

14. Hedigan F, Sheridan H, Sasse A. Benefit of inhalation aromatherapy as a complementary treatment for stress and anxiety in a clinical setting - a systematic review. Complement Ther Clin Pract. 2023; 52: 101750. (PMID: 37031643) [Crossref]
15. Cavanagh HM, Wilkinson JM. Lavender essential oil: a review. Australian Infection Control. 2005; 10: 35-37. [Crossref]
16. Silva GL, Luft C, Lunardelli A, Amaral RH, Melo DA, Donadio MV, et al. Antioxidant, analgesic and anti-inflammatory effects of lavender essential oil. An Acad Bras Cienc. 2015; 87(2 Suppl): 1397-1408. (PMID: 26247152) [Crossref]
17. Ali B, Al-Wabel NA, Shams S, Ahamad A, Khan SA, Anwar F. Essential oils used in aromatherapy: a systemic review. Asian Pac J Trop Biomed. 2015; 5: 601-611. [Crossref]
18. Tisserand R, Balacs T. Essential oil safety. Int J Aromather. 1996; 7: 28-32. [Crossref]
19. Kennedy D, Okello E, Chazot P, Howes MJ, Ohiomokhare S, Jackson P, et al. Volatile terpenes and brain function: investigation of the cognitive and mood effects of mentha × piperita l. Essential oil with in vitro properties relevant to central nervous system function. Nutrients. 2018; 10: 1029. (PMID: 3008729420) [Crossref]
20. Öner N. Le Compt A. Handbook of the state-trait anxiety inventory 2nd Edition ed: Istanbul: Bogazici University Press.; 1998. [Crossref]
21. Spielberger CD, Gorsuch RL, Lushene RE. The State-Trait Anxiety Inventory (Test Manual): Palo Alto, California: Consulting Psychologists Press; 1970. [Crossref]
22. Crichton N. Visual analogue scale (VAS). J Clin Nurs. 2001; 10: 697-706. [Crossref]
23. Weaver C, Yackzan S, Herron R, Nettro A, Davies C. Essential oil use with breast imaging a pilot study. J Holist Nurs. 2021;39:108-115. Erratum in: J Holist Nurs. 2022; 40: NP1-NP5. (PMID: 32639847) [Crossref]
24. Shammas RL, Marks CE, Broadwater G, Le E, Glener AD, Sergesketter AR, et al. The effect of lavender oil on perioperative pain, anxiety, depression, and sleep after microvascular breast reconstruction: a prospective, single-blinded, randomized, controlled trial. J Reconstr Microsurg. 2021; 37: 530-540. (PMID: 33548936) [Crossref]
25. İlter SM, Ovayolu Ö, Ovayolu N. The effect of inhaler aromatherapy on invasive pain, procedure adherence, vital signs, and saturation during port catheterization in oncology patients. Holist Nurs Pract. 2019; 33: 146-154. (PMID: 3097343) [Crossref]
26. Johnson JR, Rivard RL, Griffin KH, Kolste AK, Joswiak D, Kinney ME, et al. The effectiveness of nurse-delivered aromatherapy in an acute care setting. Complement Ther Med. 2016; 25: 164-169. (PMID: 27062964) [Crossref]
27. Caumo W, Schmidt AP, Schneider CN, Bergmann J, Iwamoto CW, Bandeira D, et al. Risk factors for preoperative anxiety in adults. Acta Anaesthesiol Scand. 2001; 45: 298-307. (PMID: 11207465) [Crossref]
28. Nishimori M, Moerman N, Fukuhara S, van Dam FS, Muller MJ, Hanaoka K, et al. Translation and validation of the Amsterdam preoperative anxiety and information scale (APAIS) for use in Japan. Qual Life Res. 2002; 11: 361-364. (PMID: 12086121) [Crossref]
29. Ozalp G, Sarioglu R, Tuncel G, Aslan K, Kadiogullari N. Preoperative emotional states in patients with breast cancer and postoperative pain. Acta Anaesthesiol Scand. 2003; 47: 26-29. (PMID: 12492793) [Crossref]