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Investigation of the Effect of Peppermint Oil Inhalation on Postoperative Nausea- Vomiting and Comfort: A Randomized Controlled Trial

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ABSTRACT

This study aimed to determine the effect of peppermint oil inhalation on postoperative nausea, vomiting, and comfort. Randomized controlled stud. The population of the study consisted of patients who underwent surgery in the general surgery department of a hospital in western Turkey between January and February 2023. Using the block randomization method, the study was completed with 31 control and 31 experimental group patients. The data were collected with the personal information form, Apfel Score, the Visual Analogue Scale (VAS)- Nausea severity, and the Comfort Scale. Student's t-test, One-Way Analysis of Variance for Repeated Measures, Pearson correlation analysis, and Cohen's and eta squared for effect size were used to analyze the data. The VAS nausea severity of the experimental group patients measured at postop 30 min., 2, 6, 12, and 24 hours was significantly lower than the control group ($p<0.05$). The vomiting rate of the control group until the postop 24. hour was found to be statistically higher than the experimental group ($x^2=6.643$, $p=0.024$). Patients in the experimental group had statistically significantly higher total scores ($p<0.001$), and Relief ($p<0.001$), and Transcendence ($p<0.001$) sub-dimension scores of the General Comfort Scale than the control group. Our study shows that peppermint oil inhalation contributes to the reduction of postoperative nausea-vomiting symptoms and an increase in comfort level.

Keywords: Postoperative, peppermint oil, nausea-vomiting, comfort

INTRODUCTION

Nausea/vomiting, one of the early complications after surgical intervention, is an undesirable condition that develops on the first postoperative day and can persist with varying severity until the third day, greatly impairing the person's comfort and recovery process (Aktaş, 2017; Hines et al., 2018). Despite numerous relevant studies and available antiemetic drugs, postoperative nausea and vomiting still have a high incidence (Rahman et al., 2022). The incidence of nausea and vomiting is reported to vary between 25-70% in the literature (Dağıstanlı et al., 2018). Nausea and vomiting due to the variety of drugs and anesthetic substances used in the postoperative period reduce patient satisfaction and comfort and causes prolonged hospitalization (Yavaşçaoğlu et al., 2009).

Postoperative vomiting also leads to negative consequences such as pulmonary aspiration, fluid electrolyte imbalance, emphysema, and delayed wound healing (Golembiewski et al., 2005). Factors like female gender, surgeries lasting longer than one hour, and a history of carsickness constitute risk factors for nausea and vomiting (Ferruggiari et al., 2012).

Despite the lack of sufficient evidence, aromatherapy applications that positively affect individuals holistically and spiritually have been used by health professionals since the last quarter of the 20th century to provide comfort to individuals and control the symptoms of nausea and vomiting (Hines et al., 2012). Aromatherapy is a treatment method involving the use of herbal essences like lavender, clove, grapefruit, tea tree oil, and peppermint oil. Peppermint oil is one of the herbal products used for medicinal purposes since ancient times and is recommended in the treatment of nausea and vomiting thanks to its antiemetic and spasmolytic effects on the gastrointestinal system (Lane et al., 2012; Sites et al., 2014).

This study aimed to determine the effect of peppermint oil inhalation, which various studies suggest having positive effects on many variables, on postoperative nausea-vomiting and comfort levels of patients.

METHODS

Purpose and Type of Research

This randomized controlled study was conducted to determine the effect of peppermint oil inhalation on postoperative nausea-vomiting and comfort.

Population and Sample of the Study

The sample size required for the study was calculated by G Power analysis (Ertürk and Taşcı 2019). Mean nausea and vomiting index scores in the study conducted by Ertürk and Taşcı (2019) were taken as the basis, and the sample to represent the population was calculated with a 5% type I error level, 95% power and an effect size of 0.79. As a result of statistical analysis, the study had to be conducted with a minimum of 56 patients, 28 patients in each group. In case of data loss, approximately 5% more participants were included in the study and 31 participants were planned to be assigned to each group. The study was completed with 31 patients in the experimental group and 31 patients in the control group. The CONSORT flow diagram of the study is given in Figure 1. The power of the study was determined as 85.5% in the post hoc analysis according to the severity of VAS-nausea. Inclusion criteria were being over 18 years of age, not having communicative/severe hearing or speech impairment, not using antidepressants and narcotic derivatives, not having a history of asthma, eczema, and allergy to flowers and plants, having ASA Score I and II, not being allergic to peppermint oil, not having emergency surgery, and volunteering to participate in the study.

Randomization

In studies with small sample groups, the block randomization method is used to ensure that the numbers in different groups are equal. In this method, the number of groups and their probabilities must be equal in each block. When there are two groups (A and B), the size of the blocks should be 2, 4, 6, ... (Machin et al., 2010). In block randomization, 4 paired combinations of A and B were first generated to obtain 6 different outcomes: ABAB(1); ABBA(2); BBAA(3); AABB(4); BAAB(5); BABA(6) (6 combinations). After the number of groups to be formed was determined as 40/4=10, the numbers from 1 to 6 were randomly distributed 10 times using randomizer.org.

Blinding

In this randomized controlled trial, the interventions (providing peppermint oil inhalation and collecting data) to be applied to the experimental and control groups to prevent bias were applied by two external nurses (experienced in data collection form) other than the researchers of the study. Because one of the nurses worked the day shift, she was in charge of all patients who had surgery during the day. Patients whose postoperative period coincided with out-of-working hours were followed up by the other nurse. The block randomization scheme was given to the nurses who would

perform the application and all data collection stages were performed by them. Thus, the researchers were blinded. The data were transferred to the statistical program by another person who did not know who was in the experimental and control groups by giving codes as A and B to the groups, thus blinding the statistician. Statistical and reporting bias was taken under control by blinding the statistical expert. After the data analysis process and reporting were completed, the codes of the research were revealed by the person who entered the data.

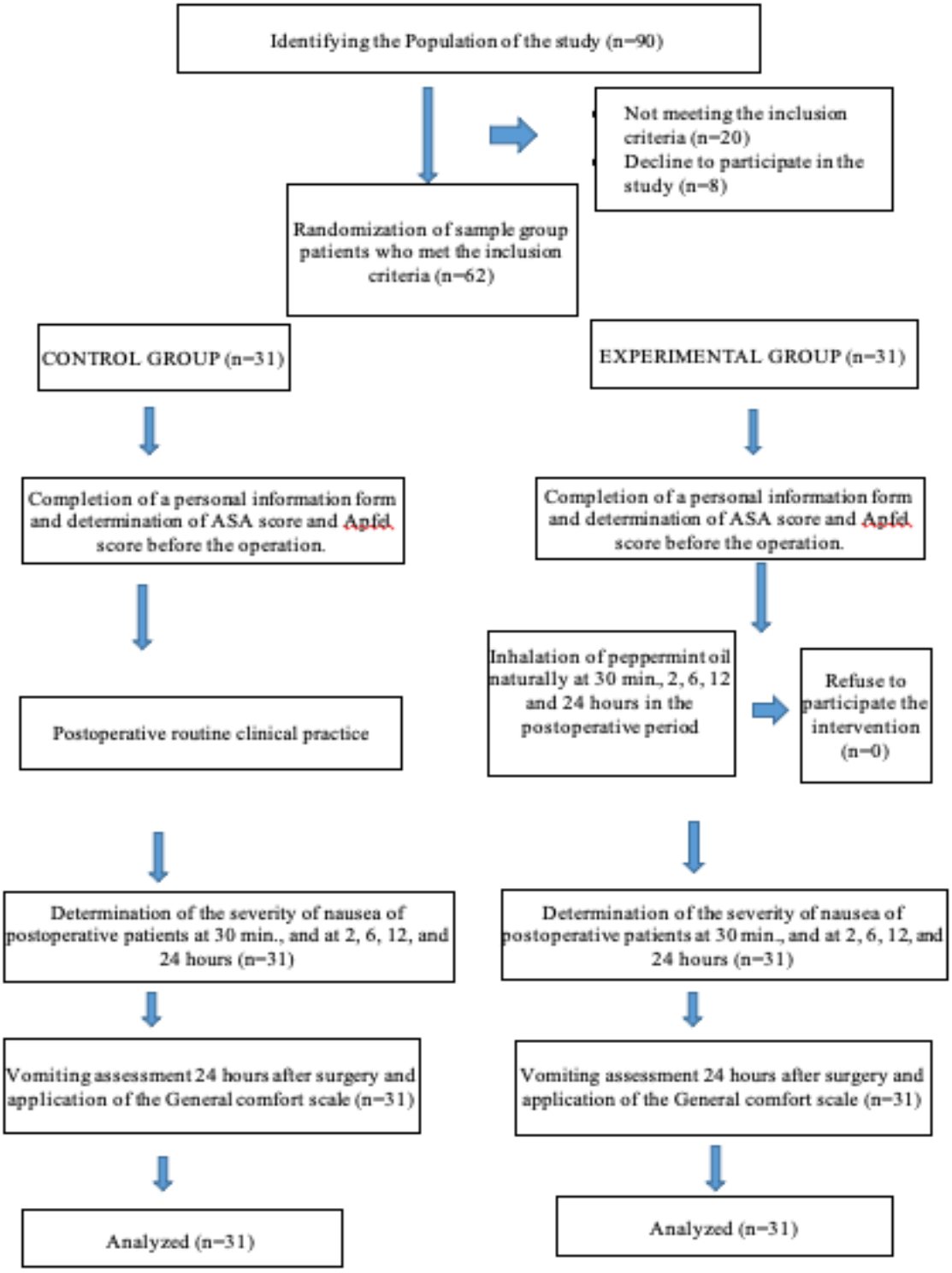

Figure 1. CONSORT flow diagram

Hypotheses of the Research

H0. Peppermint oil inhalation does not reduce the severity of postoperative nausea and vomiting symptoms.

H1. Peppermint oil inhalation reduces the severity of postoperative nausea and vomiting.

H0. Peppermint oil inhalation does not affect improving postoperative comfort.

H0. Peppermint oil inhalation has an effect on improving postoperative comfort.

Data collection

The data were collected between January-February 2023 using the face-to-face interview method. Patients in the control group were monitored for postoperative nausea severity and vomiting. Postoperative follow-ups were performed at 30 min., 2nd, 6th, 12th, and 24th hours and recorded by the nurse without any intervention.

At postop 30 min., 2, 6, 12, and 24 hours 2 drops of 100% Mentha Piperita Oil peppermint oil were instilled into a 2x2 gauze, and inhalation was administered to the experimental group. The product used has US Food and Drug Administration Approval (FDA), Good Manufacturing Practices Certificate (GMP), Halal certificate, and TSE-approved ISO 22000 and 9001 certificates. The peppermint oil bottle is 10 ml in size and dark colored. After the application, the patients were evaluated for nausea and vomiting by the nurse. The concentration of peppermint oil is 100%. All patients were followed up postop 24 hours in terms of comfort level.

Data collection tools

The data were collected by the personal information form, Apfel Score, the VAS- Nausea severity, and the Comfort Scale.

The Personal Information Form: The form consists of two parts. The first part includes 10 questions prepared reviewing the literature about the patients' preliminary diagnosis, age, gender, marital status, educational status, income status, social security status, employment status, and the number of children (Hines et al., 2012; Ferruggiari et al., 2012; Hodge et al., 2014). The second section included 14 questions about the ASA score, presence of chronic disease, complementary medicine methods used, use of peppermint for nausea and vomiting, previous hospitalization, history of surgery, presence of preoperative nausea and vomiting, duration of surgery, type of anesthesia, Apfel score, preoperative antiemetic use and antiemetic use during surgery.

Apfel Score: This score includes variables such as female gender, not being a smoker, postoperative history of nausea and vomiting or carsickness, and planned use of opioids for postoperative analgesia. Patients receive 1 point for each item. Scoring can vary from 0 to 4. High scores indicate a high risk of postoperative nausea and vomiting (Apfel et al., 1999).

The VAS-Nausea Severity: The VAS scale measures the severity of nausea and vomiting on a scale of 0-10. It was used to determine the severity of nausea (0: no nausea, 10: severe vomiting) at 30 min., 2, 6, 12, and 24 hours postoperatively.

The General Comfort Questionnaire (GCQ): The questionnaire prepared by Çıtlık Sarıtaş et al. consists of 28 questions and demonstrates the current comfort status of the patient. The scoring of the questionnaire varies between 28 and 168. The scoring of the 6-point Likert-type scale is 1-strictly disagree-6-strictly agree. Permission to use the scale was obtained from Çıtlık Sarıtaş via e-mail. The Cronbach alpha value of the scale for this study is .72. (Çıtlak Sarıtas et al., 2018).

Data analysis

Statistical evaluation was performed with IBM SPSS 23 (IBM Corp., Armonk, NY, USA) package program. Compliance with normal distribution was determined by the Shapiro-Wilk test and Skewness and Kurtosis values (-2 and +2). Descriptive statistics were given as numbers (n), percentages (%), and arithmetic mean ± standard deviation (mean ± SD). A chi-square test ($\chi 2$) was used to analyze the data, an independent sample t-test was used to compare the data between two independent groups, and the difference between the nausea severity measurements of the patients according to time was evaluated by One-Way Analysis of Variance in Repeated Measures. Bonferroni test was performed to determine the interventions where a significant difference originated. In our study, Cohen's d was used to calculate the effect size of the significant difference in the independent sample t-test results, and $\eta 2$ (Eta square) coefficient was used to calculate the effect size of the significant difference in the variance analysis results. The relationships between variables were evaluated by Pearson correlation analysis.

Ethical Considerations

Prior to the research, ethics committee permission was obtained from Gümüşhane University Ethics Committee (Date: 27/04/2022 Number No: 2022/3). In addition, written permission was obtained from the relevant hospital by informing them of the scope of the study. Permission to use the scales used in the study was obtained online from the authors who adapted them into Turkish. The patients to be included in the study were informed about the research and the patients who volunteered were recruited for the study after filling out the consent form. The research was conducted following the Declaration of Helsinki. The clinical Trial number is NCT05585086.

Findings

There was no statistically significant difference between the descriptive characteristics of the experimental and control group patients ($p>0.05$) (Table 1).

Table 1. Comparison of the descriptive characteristics of the participants in the experimental and control groups

Characteristics	Experimental group (n=31)		Control group (n=31)		Statistic*
	n	%	n	%	
Gender					
Female	15	48.4	16	51.6	x^2=0.065
Male	16	51.6	15	48.4	p=0.799
Marital status					
Married	22	71.0	28	90.3	x^2=3.72
Single	9	29.0	3	9.7	p=0.054
Education status					
Illiterate	3	9.7	3	9.7	x^2=5.093**
Primary school	14	45.2	9	29.0	p=0.405
Secondary school	6	19.3	7	22.6	
High school	4	12.9	7	22.6	
University and above	4	12.9	5	16.1	
Income status					
Income equal to expenses	24	77.4	24	77.4	x^2<0.001
Income less than expenses	7	22.6	7	22.6	p=1.000
ASA score					
ASA I	16	51.6	14	45.2	x^2=0.258
ASA II	15	48.4	17	54.8	p=0.611
Chronic disease					
Yes	16	51.6	19	61.3	x^2=0.258
No	15	48.4	12	38.7	p=0.611

Characteristics	Experimental group (n=31)		Control group (n=31)		Statistic*
	n	%	n	%	
Use of alternative medicine Yes No	 7 24	 22.6 77.4	 3 28	 9.7 90.3	 x^2=1.908* p=0.301
History of surgery Yes No	 22 9	 71.0 29.0	 19 12	 61.3 38.7	 x^2=0.648 p=0.421
Age (mean±SD)	53.35±15.51		54.09±10.82		t***=-0.218 p=0.828
Apfel score (mean±SD)	1.96±0.87		1.74±0.77		t***=1.077 p=0.286

*Chi-square test (x2), **Fisher's Exact Test, ***Student t-test, ASA I: Normal healthy patient, ASA II: Patient with mild systemic disease

According to the results, the Apfel score of 35.5%, 35.5%, and 29.0% of the patients in the experimental group had 1, 2, and 3 points, respectively. In the control group, the Apfel score of 45.2%, 35.5%, and 19.5% of the patients had 1, 2, and 3 points, respectively (Figure 2).

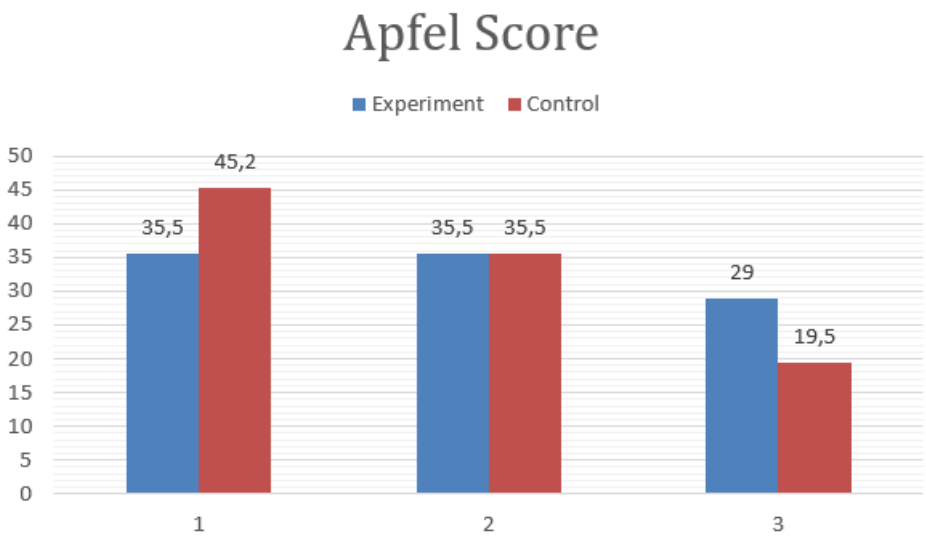

Figure 2. Distribution of Apfel scores of the patients

There was no significant difference between the 30 min. postop VAS nausea severity of the experimental and control group patients (p=0.934). However, the VAS nausea severity of the experimental group patients measured postop 2, 6, 12, and 24 hours was significantly lower than the control group (p<0.05). The effect sizes of the VAS nausea severities measured at 2, 6, 12, and 24 hours, which were statistically significantly different between the groups, showed that the results were clinically effective at moderate and high levels (Cohen's d=0.629, Cohen's d=0.761, Cohen's d=0.855, Cohen's d=1.360, respectively). A statistically significant difference was found between the VAS nausea severity of the experimental (p<0.001) and control group (p<0.001) according to the in-group measurement times. As a result of repeated measures analysis of variance, it was found that the effect of group*time interaction was statistically significant and had a weak effect size (p<0.001) (Table 2).

Table 2. Distribution of VAS Nausea Severity Scores of Individuals in the Experimental and Control Groups Based on Measurement Times After Peppermint Oil Inhalation

Measurement Time	VAS Nausea Severity		Statistic			
	Experimental group (n=31) (Mean±SD)	Control Group (n=31) (Mean±SD)	t	p[a]	Effect Size [c]	SMD (95% CI)
Postop 30 min[1]	4.70±1.88	4.74±1.06	-0.083	0.934		
Postop 2 hours[2]	3.58±1.82	4.61±1.43	-2.482	0.016	0.629	1.03 (0.20-1.86)
Postop 6 hours[3]	2.87±1.85	4.12±1.40	-3.005	0.004	0.761	1.25 (0.42-2.08)
Postop 12 hours[4]	2.22±1.64	3.45±1.20	-3.342	0.001	0.855	1.23 (0.50-1.96)
Postop 24 hours[5]	1.12±1.43	2.96±1.27	-5.335	<0.001	1.360	1.84 (1.15-2.53)
Test value[b]; p	72.849; <0.001	30.273; <0.001				
Pairwise comparisons	1>2, 1>3, 1>4, 1>5, 2>3, 2>4, 2>5, 3>4, 3>5, 4>5	1>4, 1>5, 2>4, 2>5, 3>4, 3>5, 4>5				
Group*Time				<0.001	0.140[d]	

[a] Student t test; [b] One-way Analysis of Variance in Repeated Measures (F); c Cohen's d, [d]Eta squared(η2)

The rate of vomiting (19.4%) in the control group patients until the 24th postoperative hour was statistically significantly higher than that of the experimental group (x^2=6.643, p=0.024) (Table 3).

Table 3. Comparison of Vomiting Status of Experimental and Control Groups at 24th Hour Postop

Characteristics	Experimental group (n=31)		Control group (n=31)		Statistic
	n	%	n	%	
Vomiting Yes No	 0 31	 - 100	 6 25	 19.4 80.6	 x^2=6.643 p=0.024*

*Fisher's Exact Test

The total scores of the General Comfort Scale (p<0.001), Refreshment (p<0.001), and Transcendence (p<0.001) sub-dimension scores of the patients in the experimental group were found to be statistically significantly higher than those of the control group. The effect sizes of the General Comfort Scale scores, which had statistically significant differences between the groups, showed that the results were clinically highly effective (Cohen's d=1.850, Cohen's d=1.209, Cohen's d=1.819, respectively) (Table 4).

Table 4. Comparison of Experimental and Control Groups According to Postoperative Comfort Levels

Scale	Experimental group (n=31) (Mean±SD)	Control group (n=31) (Mean±SD)	t;p[a]	Cohen d
General Comfort Questionnaire	111.35±12.30	93.80±5.25	8.13;<0.001	1.850
Relief	41.74±8.35	34.25±2.64	4.75;<0.001	1.209
Ease	28.12±4.91	26.25±2.86	1.83;0.072	
Transcendence	43.48±7.12	33.29±3.47	7.15;<0.001	1.819

[a] Student t-test

There was a negative and moderately significant relationship between VAS nausea severity and comfort levels of the patients in the experimental group at postop 30 min., and 2, 6, 12, and 24 hours ($p<0.05$). In addition, a significant positive correlation was determined between VAS nausea severity at postop 30 min., and 2, 6, 12, and 24 hours after surgery and Apfel scores of the experimental and control group patients ($p<0.05$) (Table 5).

Table 5. The relationship between Apfel scores, postoperative VAS nausea severity, and comfort levels of the Experimental and Control Groups

	Experimental group							Control Group						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
(1) 30 min. VAS nausea severity r p	1.00	0.867 <0.001	0.799 <0.001	0.677 <0.001	0.497 0.004	0.439 0.013	-0.369 0.041	1.00	0.568 0.001	0.579 0.001	0.613 <0.001	0.362 0.046	0.484 0.006	0.217 0.240
(2) 2. hour VAS nausea severity r p		1.00	0.860 <0.001	0.766 <0.001	0.662 <0.001	0.598 <0.001	-0.546 0.001		1.00	0.688 <0.001	0.819 <0.001	0.577 0.001	0.479 0.006	0.194 0.296
(3) 6. hour VAS nausea severity r p			1.00	0.903 <0.001	0.658 <0.001	0.490 0.005	-0.373 0.039			1.00	0.828 <0.001	0.632 <0.001	0.399 0.026	0.089 0.634
(4) 12. hour VAS nausea severity r p				1.00	0.765 <0.001	0.560 0.001	-0.416 0.020				1.00	0.767 <0.001	0.415 0.020	0.167 0.370
(5) 24. hour VAS nausea severity r p					1.00	0.536 0.002	-0.425 0.017					1.00	0.327 0.028	0.118 0.527
(6) Apfel Score r p						1.00	-0.308 0.091						1.00	0.160 0.391
(7) General comfort level r p							1.00							1.00

DISCUSSION

In this study, the effect of peppermint oil inhalation on postoperative nausea-vomiting, and comfort was investigated in a randomized controlled design. According to our results, inhaling peppermint oil reduces postoperative nausea-vomiting symptoms and increases the comfort level.

In our study, the patients in the experimental and control groups were similar in terms of descriptive characteristics. The similar characteristics of both groups are thought to be important in terms of evaluating the effectiveness of peppermint oil inhalation on postoperative nausea-vomiting and comfort.

In our study, no significant difference was found between the nausea severity of the experimental and control group patients at postop 30 min., showing that peppermint oil inhalation in the first 30 min. of the postoperative period was not effective on the severity of postoperative nausea.

It was found that the nausea severity of the experimental group was statistically significantly lower than the control group at the postop 2nd, 6th, 12th, and 24th hours. In addition, the patients in the experimental group had a significant decrease in vomiting symptoms after peppermint oil application compared to the control group. Our study results show that peppermint oil inhalation has a positive effect on the severity of nausea of patients at the postop 2nd, 6th, 12th, and 24th hours. In the literature, there are studies similar to our study results as well as different studies. Similar to our study, Mohr et al. reported a decrease in the severity of nausea in patients who were applied peppermint oil inhalation (Mohr et al., 2021).

Hunt et al. reported that an aromatic oil mixture, including peppermint oil, significantly reduced the severity of postoperative nausea (Hunt et al., 2013). Lane et al. examined the effect of peppermint inhalation on nausea in women after cesarean section surgery and found that the severity of nausea 2 and 5 min after inhalation was statistically significantly lower than the group receiving placebo and antiemetic. Similarly, Brigg et al. examined 123 patients undergoing cardiac surgery and reported that the nausea severity of patients after peppermint oil inhalation was statistically significantly lower than before inhalation (Brigg et al, 2016). Unlike our study, Anderson and Gross., in a study in which they applied postop peppermint oil inhalation to patients in the experimental group, stated that although there was a decrease in nausea severity after inhalation, the difference between the experimental and control groups was not significant (Anderson et al., 2004). Sites et al. also found that postoperative peppermint oil inhalation did not significantly reduce nausea (Sites et al, 2014). Ferruggiari et al. evaluated the effect of aromatherapy on the severity of postoperative nausea in women undergoing surgical intervention in the post-anesthesia care unit and divided the patients into three groups peppermint oil group, saline vapor group, and antiemetic group. No difference was found between the groups in terms of nausea severity in the evaluations made 5 and 10 min. after the intervention (Ferruggiari et al. 2012).

Demanding comfort is a natural wish for both healthy and sick individuals. Postoperative patient satisfaction is largely related to patient comfort. Aromatherapy, including various methods such as massage, inhalation, compression, and bath to protect and improve physical and psychological health, and according to its therapeutic properties, is used to heal the person and increase comfort (Gül & Eti Aslan, 2012; Özdemir & Öztunç, 2013; Metin & Ozdemir, 2016). No study, to our knowledge, has examined the effect of peppermint oil inhalation on the comfort level of the patient. In a randomized controlled study, Nord and Belew reported that although lavender and ginger oil applied inhalation and topically had positive effects on comfort, there was no statistically significant difference (Nord & Belew, 2009).

The “Apfel Scoring” developed by Apfel et al. is a risk assessment scale for nausea and vomiting. Basically, the nausea and vomiting score is determined for the patient by evaluating four risk factors (female gender, not being a smoker, postoperative history of nausea and vomiting or carsickness, planned use of opioids for postoperative analgesia) (Apfel et al. 1999). In our study, as the Apfel scores of the patients in the experimental and control groups increased, the severity of nausea at postop 30 min., and 2, 6, 12, and 24 hours also increased. According to the systematic review by Hines et al, the Apfel score was found to be at a moderate/low level, and it was recommended that the patient should be evaluated at the postop 6th, and 24th hours (Hines et al, 2018). It is emphasized that postoperative nausea and vomiting decreased in patients undergoing surgical intervention evaluated with Apfel Scoring (Sigaut et al, 2010; Pierre et al, 2004). Such risk assessments are considered important since they raise nurses’ awareness of their patients (Yaman Aktaş et al., 2018). Altun Bingöl et al. emphasized that a high Apfel score was associated with nausea and vomiting within postop 2 hours (Altun Bingöl et al., 2022).

CONCLUSION AND RECOMMENDATIONS

Our study results show that the use of peppermint oil inhalation may contribute to the improvement of postoperative nausea-vomiting symptoms and the comfort level of patients.

Nurses play a crucial role in mitigating the major risk factors that contribute to postoperative nausea and vomiting. Therefore, patients should be routinely assessed for risk factors in the preoperative period to provide effective nausea and vomiting management. Vomiting assessment should be performed objectively as in pain assessment and should be recorded using a numerical (0-10) or verbal scale (none, mild, moderate, severe). In addition, nurses should be aware of the risk approaches available and the effects of treatment and antiemetic drugs prescribed. Nurses can minimize the use of opioids with nonpharmacological practices in the management of postoperative nausea and vomiting symptoms.

Strengths and Limitations of the Study

The trial was structured according to the CONSORT 2017 checklist (CONSORT 2017 checklist of information to include when reporting a randomized trial). The block randomization method was used to ensure randomization to prevent intergroup interaction between participants and ensure equal numbers in different groups. To prevent bias in our study, the data were collected by two external nurses other than the researchers conducting the study. The data were analyzed with appropriate statistical methods, and the effect size was calculated. The study is thought to contribute to the creation of new and more effective application methods for nurses in the management of nausea, vomiting, and comfort in the postoperative phase, as well as the benefits it brings to patients. The main identified limitation of the study is that patients treated in the postoperative period in the general surgery service of a hospital in Turkey were included in the study.

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Declaration of Competing Interests

The authors declare no conflict of interest.

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Data availability

The datasets generated during and/or analysed during the current study are available from the authors upon reasonable request.

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