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Peppermint aromatherapy for post-chemotherapy nausea and vomiting in breast cancer patients

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Abstract

Background: Chemotherapy is the main treatment for breast cancer patients but often causes side effects such as nausea and vomiting, which can reduce patients' quality of life. Peppermint aromatherapy is a complementary therapy that has antiemetic and relaxation effects.

Purpose: To determine the effect of peppermint aromatherapy on nausea and vomiting scores in breast cancer patients after chemotherapy.

Method: This study used a quasi-experimental design with a one-group pre-test and post-test approach. The sample consisted of 20 breast cancer patients undergoing chemotherapy, selected using purposive sampling. Nausea and vomiting scores were measured before and after the intervention using an observation sheet and analyzed using a paired t-test.

Results: The results showed a decrease in the mean nausea and vomiting scores after peppermint aromatherapy. Statistical analysis indicated a significant difference between pre-test and post-test scores ($p < 0.05$).

Conclusion: It can be concluded that peppermint aromatherapy is effective in reducing nausea and vomiting in breast cancer patients after chemotherapy and can be used as a safe and simple non-pharmacological nursing intervention.

Keywords : Breast Cancer; Chemotherapy; Nausea And Vomiting; Peppermint Aromatherapy.

INTRODUCTION

Cancer is one of the major public health challenges, both in Indonesia and globally. In Indonesia, the incidence, prevalence, morbidity, and mortality associated with cancer have continued to increase each year. Based on research findings and reports from the Ministry of Health, the cancer burden in Indonesia is increasing in terms of both the number of cases and its complexity (Nisa et al., 2021). Cancer remains one of the major health problems worldwide, affecting both developed and developing countries. It comprises a group of diseases characterized by the uncontrolled growth of abnormal cells, which can develop into malignant tumors that damage and

destroy healthy tissues and cells. Cancer is the second leading cause of death worldwide, accounting for approximately 9.6 million deaths annually (Ministry of Health of the Republic of Indonesia, 2023). Currently, breast cancer is the most commonly diagnosed cancer among women (Ministry of Health of the Republic of Indonesia, 2022).

According to the World Health Organization (WHO), more than 2.3 million new cases of breast cancer are diagnosed worldwide each year. WHO also reported that mortality due to breast cancer remains substantial among affected populations (World Health Organization, 2023). According to data

from the International Agency for Research on Cancer (IARC) in 2023, Indonesia recorded approximately 408,661 new cancer cases and 242,988 cancer-related deaths. This burden is expected to continue increasing if comprehensive and sustainable cancer prevention and control measures are not implemented. Globally, there were approximately 2.2968 million new cases of breast cancer and 666,150 deaths. In Asia, approximately 985,400 new cases and 315,100 deaths were estimated, with corresponding age-standardized incidence and mortality rates (World Health Organization, 2022).

The prevalence of breast cancer in Indonesia is estimated at 42.1 per 100,000 population. Breast cancer ranks first among the causes of cancer-related deaths in Indonesia (Sembiring, 2023). The Ministry of Health of the Republic of Indonesia continues to accelerate efforts to address the breast cancer burden in the country. Currently, breast cancer is the most commonly diagnosed cancer in Indonesia. According to data from the Ministry of Health, there were 66,271 new cases of breast cancer and 22,598 deaths attributed to the disease (Ministry of Health of the Republic of Indonesia, 2025). According to the 2023 Health Profile of the Lampung Provincial Health Office, approximately 278 cases of tumors or breast lumps were recorded, representing 0.1% of cases, while 299 cases of breast cancer were also reported, accounting for 0.1%. In addition, 295 cases of tumors and suspected breast cancer were referred for further examination and management, representing approximately 58.2% of the total cases reported across the 15 districts/cities in Lampung Province (Lampung Province Health Office, 2024).

Physically, breast cancer can cause various changes in the body, particularly in the breast area. The breast skin may appear red, lesions may develop, and breast tissue may shrink, causing the breast to appear sagging. In addition, patients may experience significant weight loss, resulting in a thinner body appearance. Abnormal cancer cells can spread to other parts of the body through the bloodstream, a process known as metastasis. When the cancer spreads to vital organs such as the bones, liver, lungs, or brain, the functions of these organs may become impaired, potentially leading to serious complications and even death (Harmia & Mayasari, 2022). A major characteristic of cancer, which is

classified as a non-communicable disease, is the rapid and uncontrolled growth and division of cells. This condition may progress to metastasis, in which cancer cells spread from the original tissue to other parts of the body (Suparna & Sari, 2022).

One of the treatment modalities used in the management of breast cancer is chemotherapy. Chemotherapy is an anticancer treatment that uses specific drugs to kill, destroy, or inhibit the growth of residual cancer cells that cannot be removed through surgery. However, the adverse effects of chemotherapy are not limited to cancer cells; healthy cells may also be damaged, particularly those with a high rate of cell division. Chemotherapy can be administered intravenously or orally and is generally given over several months, with rest periods between cycles to allow the body to recover. A combination of several chemotherapy agents is commonly used because it is considered more effective than single-agent therapy. Cytostatic drugs work by damaging DNA (deoxyribonucleic acid) or inhibiting the process of cell division.

Chemotherapy is a cancer treatment involving the administration of cytostatic drugs that function to destroy cancer cells. This therapy is systemic, meaning that it can affect the entire body through both therapeutic responses and adverse effects. Several acute reactions may occur rapidly and can potentially be life-threatening, including allergic reactions, hypersensitivity, and chemotherapy drug extravasation. In the long term, monitoring of cardiac, neurological, renal, and hematopoietic function is essential to prevent harmful adverse drug effects. One chemotherapy drug commonly used is doxorubicin, which inhibits or slows cancer cell growth by interfering with topoisomerase II, an enzyme required for cancer cells to grow and divide (Chairunnisa et al., 2024).

Chemotherapy has brought significant changes to the course of cancer treatment. Whereas cancer was previously often associated with terminal and fatal outcomes, advances in chemotherapy have made it possible to treat the disease and, in some cases, achieve a cure through appropriate therapeutic approaches. The primary goal of chemotherapy is to inhibit cancer cell proliferation and tumor growth, thereby preventing invasion and metastasis. Despite its effectiveness, chemotherapy frequently causes various adverse effects, including myelosuppression,

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increased risk of infection, nausea and vomiting, nephrotoxicity, loss of appetite, hair loss, and diarrhea. One of the most common adverse effects is chemotherapy-induced nausea and vomiting (CINV), which affects more than 40% of patients. If inadequately managed, CINV can lead to serious complications, including metabolic disturbances, malnutrition and anorexia, electrolyte imbalance, psychological disturbances and reduced physical functioning, esophageal tears, fractures, wound dehiscence, and disruption of cancer treatment continuity. Furthermore, CINV may interfere with cancer treatment by reducing patient adherence to therapy. It can also negatively affect patients' quality of life, decrease appetite, and reduce the overall effectiveness of treatment (Nuzulullail et al., 2025).

Nausea and vomiting in patients undergoing chemotherapy occur as a result of stimulation by cytotoxic agents in chemotherapy drugs, which activate the chemoreceptor trigger zone (CTZ) in the medulla of the brain. The CTZ functions as a receptor that initiates the sensation of nausea and vomiting. Inadequate management of these symptoms can reduce patient adherence to treatment and interfere with daily functional activities. Because chemotherapy is administered as an ongoing treatment, prolonged nausea and vomiting may result in fluid and nutritional deficiencies. The resulting physical weakness may make patients less prepared to undergo subsequent chemotherapy sessions (Ardhiansyah, 2021). Therefore, effective complementary therapies are needed to reduce nausea and vomiting without causing significant adverse effects. Nurses play an important role in providing treatment and support to patients. One non-pharmacological method that can be used to help relieve nausea and vomiting during chemotherapy is peppermint aromatherapy (Tianto & Khayati, 2023).

When peppermint essential oil molecules are inhaled, the aromatic particles are detected by olfactory receptors in the nose and subsequently transmit signals to the brain. This process activates areas associated with emotional responses, which may influence the body's circulatory system and produce a relaxing effect. Consequently, sensations of nausea and vomiting may be reduced (Khasanah et al., 2021).

Based on the available evidence, the management of post-chemotherapy nausea and

vomiting can involve a combination of pharmacological and non-pharmacological therapies. Pharmacological therapy with antiemetic drugs remains necessary for medical symptom control; however, its effectiveness may be enhanced by complementary non-pharmacological interventions such as peppermint aromatherapy. Peppermint aromatherapy has been reported to reduce the severity and intensity of nausea and vomiting due to its menthol and menthone content, which may exert natural antiemetic and antispasmodic effects by relaxing gastrointestinal smooth muscle and reducing stimulation of the vomiting center in the brain.

With regular application of peppermint aromatherapy, either through inhalation or a diffuser, patients may experience relaxation, greater comfort, and reduced nausea and vomiting with minimal adverse effects. Therefore, peppermint aromatherapy may serve as a safe, simple, and cost-effective complementary intervention to support conventional treatment and improve the quality of life of patients with breast cancer following chemotherapy.

RESEARCH METHOD

This study used a quantitative quasi-experimental design with a one-group pretest–posttest approach. The study was conducted among breast cancer patients following chemotherapy at Dr. H. Abdul Moeloek Regional General Hospital in 2025. The intervention variable was peppermint aromatherapy and the outcome variable was the nausea and vomiting score.

The study included 20 breast cancer patients who were selected using purposive sampling. Based on the manuscript, all respondents were women. The nausea and vomiting score was assessed immediately before and after the peppermint aromatherapy intervention using the study observation sheet.

Peppermint aromatherapy was administered using a roll-on inhalation method. The original manuscript does not state the concentration of peppermint essential oil, number of applications, duration of inhalation, interval between pre-test and post-test assessment, or whether concomitant antiemetic medication was standardized. These details should be added to the final manuscript because they are essential for reproducibility.

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Data were analyzed using descriptive statistics and a paired inferential test. The Shapiro–Wilk test was used to assess normality because the sample size was less than 50. The pre-test scores were normally distributed ($p = 0.087$), whereas the post-

test scores were not normally distributed ($p = 0.001$). Therefore, the Wilcoxon signed-rank test was used to compare paired pre-test and post-test scores. Statistical significance was set at $p < 0.05$.

RESEARCH RESULTS

Table 1. Characteristics of respondents (N=20)

Variable	Results
Age (Mean±SD) (Range) (Years)	
35-45	4/20.0
46-55	10/50.0
56-65	6/30.0
Gender (n/%)	
Male	0/0
Female	20/100
Education (n/%)	
Elementary School	6/30.0
Junior High School/Madrasah Tsanawiyah	3/15.0
Senior High School/Vocational School	8/40.0
Diploma (D1–D4)	2/10.0
Bachelor's Degree	1/5.0
Occupation (n/%)	
Homemaker	6/30.0
Civil Servant	3/15.0
Entrepreneur	8/20.0
Farmer	1/15.0
Employee	2/20.0

Table 1. shows that all respondents were female (20; 100.0%). Regarding educational level, most respondents had completed senior high school/vocational school (8; 40.0%), followed by elementary school (6; 30.0%), junior high school (3; 15.0%), diploma education (2; 10.0%), and bachelor's degree (1; 5.0%). In terms of occupation, the largest proportion were entrepreneurs (8; 40.0%), followed by housewives (6; 30.0%), civil servants (3; 15.0%), employees (2; 10.0%), and farmers (1; 5.0%).

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Table 2. Nausea and Vomiting Levels Before and After Peppermint Aromatherapy in Breast Cancer Patients Following Chemotherapy

Group	Mean	Standar Deviasi	Min - Max	95% CI	p-value
Pre-test	7.30	1.031	5 - 9	6.82 - 7.78	0.087
Post-test	5.80	0.696	5 - 7	5.47 – 6.13	0.001

Table 2. shows the distribution of respondents' nausea and vomiting scores before receiving the peppermint aromatherapy intervention (pre-test). Among the 20 respondents, the mean nausea and vomiting score was 7.30, with a standard deviation of 1.031. The mean score of 7.30 indicates that, on average, respondents experienced nausea and vomiting at a score of approximately 7 before the intervention. The 95% confidence interval (95% CI) ranged from 6.82 to 7.78, indicating that the mean nausea and vomiting score among respondents before the intervention was within the moderate-to-high severity range. These findings indicate that, prior to receiving peppermint aromatherapy, respondents continued to experience relatively severe nausea and vomiting following chemotherapy.

Among the 20 respondents, the mean nausea and vomiting score after the intervention decreased to 5.80, with a standard deviation of 0.696. The lower standard deviation compared with the pre-test value (1.031) indicates that the nausea and vomiting scores among respondents became more homogeneous following the intervention.

Furthermore, the decrease in the mean score from 7.30 to 5.80 indicates a reduction in the intensity of nausea and vomiting among breast cancer patients following chemotherapy after receiving peppermint aromatherapy. The 95% confidence interval (95% CI) ranged from 5.47 to 6.13, indicating that the average nausea and vomiting score after the intervention was within the moderate range. Overall, the reduction in the mean score suggests that peppermint aromatherapy had a positive clinical effect in alleviating chemotherapy-induced nausea and vomiting, with symptoms shifting from a higher level toward a lower level of severity.

The normality test was conducted to determine whether the data met the assumptions required for statistical analysis. The Shapiro–Wilk test was used because the sample consisted of fewer than 50

respondents. A p-value > 0.05 indicates that the data are normally distributed, whereas a p-value < 0.05 indicates that the data are not normally distributed.

The results showed that the pre-test nausea and vomiting scores had a p-value of 0.087, indicating a normal distribution. However, the post-test scores had a p-value of 0.001, indicating a non-normal distribution. Because at least one of the paired datasets was not normally distributed, the assumption for the paired-samples t-test was not fully met. Therefore, the Wilcoxon signed-rank test, a non-parametric alternative to the paired-samples t-test, was used to determine whether there was a significant difference in nausea and vomiting scores before and after the administration of peppermint aromatherapy.

DISCUSSION

The characteristics of respondents in this study included age and sex among breast cancer patients undergoing chemotherapy at Dr. H. Abdul Moeloek Regional General Hospital. A total of 20 respondents participated in the study. The findings showed that all respondents were female (100%). This finding is consistent with the epidemiological profile of breast cancer, which occurs predominantly in women compared with men, partly due to hormonal factors, particularly estrogen, which plays an important role in breast tissue development and the regulation of breast cell growth. This finding is supported by previous research indicating that breast cancer is the most prevalent cancer among women, with major risk factors closely associated with exposure to reproductive hormones and lifestyle factors (Gani, 2022).

Age is an important risk factor for breast cancer. Women aged 40 years and older experience significant physiological and hormonal changes, including declining ovarian function and changes in estrogen levels. Cumulative exposure to reproductive

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hormones throughout the reproductive period, together with age-related reductions in cellular DNA repair mechanisms, may increase the susceptibility of breast cells to malignant transformation and genetic mutations. Consequently, older women represent a substantial proportion of patients requiring chemotherapy and management of treatment-related adverse effects, including nausea and vomiting (Gani, 2022).

Previous research has also suggested that age may be associated with the severity of chemotherapy-related adverse effects. In women aged 40–55 years, physiological changes may affect the metabolism and elimination of cytotoxic agents. Prolonged exposure to these agents may increase stimulation of the chemoreceptor trigger zone (CTZ) and subsequently induce nausea and vomiting (Nirnasari et al., 2023). However, the relationship between age and chemotherapy-induced nausea and vomiting may also be influenced by other factors, including chemotherapy regimen, dosage, individual susceptibility, nutritional status, and the use of antiemetic medication.

The findings indicate that the respondents experiencing chemotherapy-induced nausea and vomiting at Dr. H. Abdul Moeloek Regional General Hospital were predominantly women. Therefore, appropriate supportive interventions are needed to help manage chemotherapy-related symptoms. Non-pharmacological interventions such as peppermint aromatherapy may be considered as a complementary approach to improve patient comfort and help reduce nausea and vomiting during chemotherapy.

Nausea and Vomiting Before Peppermint Aromatherapy

The results showed that the mean nausea and vomiting score among breast cancer patients before receiving peppermint aromatherapy was 7.30, with a standard deviation of 1.031. The mean score indicates that, before the intervention, respondents generally experienced nausea and vomiting at approximately score 7. These findings demonstrate that respondents experienced considerable physical discomfort following chemotherapy.

Chemotherapy is a cancer treatment that may cause various adverse effects, including chemotherapy-induced nausea and vomiting (CINV). The severity of these symptoms may vary depending

on individual physiological characteristics, the type and dose of chemotherapy agents, and the emetogenic potential of the treatment regimen (Gani, 2022). In the present study, the relatively high pre-test nausea and vomiting scores may be associated with the physiological response to cytotoxic agents, which can stimulate the chemoreceptor trigger zone (CTZ) and activate the vomiting pathway.

The standard deviation of 1.031 indicates that there was some variation in nausea and vomiting scores among respondents, although the scores remained within a relatively limited range. This suggests that most respondents experienced comparable levels of chemotherapy-related nausea and vomiting.

The symptoms experienced by respondents included abdominal discomfort and increased salivation (hypersalivation), which may accompany nausea and precede vomiting. These findings highlight the need for supportive interventions that can be administered easily and safely. Peppermint aromatherapy may be used as a complementary intervention because peppermint contains menthol, which is believed to produce a cooling and relaxing sensation and may help alleviate gastrointestinal discomfort. Previous research has reported that inhaled peppermint aromatherapy may help reduce nausea and vomiting through olfactory stimulation and its potential relaxing effects (Wijaya et al., 2024).

This finding is supported by previous research demonstrating that non-pharmacological therapy using peppermint aromatherapy can effectively reduce the intensity of nausea and vomiting due to its potential antispasmodic and carminative properties, which may help promote gastrointestinal relaxation (Devita et al., 2024). Similarly, previous research has shown that inhaled aromatherapy can significantly reduce nausea and vomiting symptoms, with the effectiveness of the intervention potentially influenced by the characteristics of the respondents (Amanda et al., 2024). Other studies have also highlighted the biological vulnerability of women to the clinical impact of breast cancer, particularly among middle-aged and older women (Sipayung et al., 2022).

The bivariate analysis in this study was conducted using the Wilcoxon signed-rank test to evaluate differences in nausea and vomiting scores before and after the peppermint aromatherapy intervention. The results showed a decrease in the mean nausea and

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vomiting score from 7.30 before the intervention to 5.80 after the intervention. This reduction indicates an improvement in the severity of nausea and vomiting following the intervention. However, the mean score alone cannot establish statistical significance; statistical significance should be determined based on the p-value obtained from the Wilcoxon signed-rank test.

The post-intervention assessment showed an improvement in nausea and vomiting symptoms among most respondents. The mean nausea and vomiting score after peppermint aromatherapy was 5.80, with a standard deviation of 0.696. The lower standard deviation compared with the pre-test value (1.031) indicates that the scores became less variable after the intervention. This finding suggests that the reduction in nausea and vomiting intensity occurred relatively consistently among the respondents.

The decrease in the mean nausea and vomiting score following peppermint aromatherapy suggests a potential improvement in the comfort and well-being of breast cancer patients following chemotherapy. Previous research has suggested that peppermint aromatherapy may help alleviate nausea through its aromatic and physiological effects. The menthol component of peppermint may produce a cooling and relaxing sensation and may contribute to gastrointestinal comfort through its potential antispasmodic properties (Wijaya et al., 2024). Through olfactory stimulation, inhaled peppermint aroma may also promote relaxation, which can help patients cope with unpleasant sensations associated with chemotherapy-induced nausea and vomiting.

The distribution of scores indicates that, after the intervention, respondents tended to have lower nausea and vomiting scores than before the intervention. This finding is consistent with Devita et al. (2024), who reported that peppermint aromatherapy was associated with a significant reduction in nausea and vomiting symptoms. The management of chemotherapy-related adverse effects is important because persistent nausea and vomiting can negatively affect nutritional intake, treatment adherence, daily functioning, and quality of life among cancer patients.

The researchers suggest that the reduction in nausea and vomiting scores may be related to the relaxing and distracting effects of peppermint aromatherapy. The pleasant aroma may provide

sensory distraction from unpleasant gastrointestinal sensations and help reduce psychological tension associated with chemotherapy. In addition, the simple application of peppermint aromatherapy may allow patients to participate actively in their symptom management. A calm treatment environment may also support patient relaxation and contribute to overall comfort during the post-chemotherapy period. Nevertheless, these factors should be interpreted as possible contributing mechanisms rather than definitive causal explanations because the present study did not independently measure psychological relaxation or environmental factors.

The bivariate analysis was performed to determine whether peppermint aromatherapy was associated with changes in nausea and vomiting scores among breast cancer patients following chemotherapy at Dr. H. Abdul Moeloek Regional General Hospital. Because the data were obtained from the same respondents before and after the intervention and the normality assumption was not fully satisfied, the Wilcoxon signed-rank test was used as the non-parametric alternative to the paired-samples t-test. The mean score decreased from 7.30 to 5.80, representing an absolute reduction of 1.50 points. The statistical test yielded a p-value of 0.000 ($p < 0.001$). Therefore, there was a statistically significant difference in nausea and vomiting scores before and after the administration of peppermint aromatherapy.

Previous research has suggested that peppermint may exert gastrointestinal effects through its menthol and menthone components, which may contribute to carminative and antispasmodic activity and provide a cooling sensation that may help reduce gastrointestinal discomfort (Pertiwi et al., 2025). Other research has reported that inhaled peppermint aromatherapy may not only help alleviate nausea but may also contribute to reducing fatigue experienced by patients undergoing chemotherapy, potentially improving both physical and psychological comfort (Suprati & Herawati, 2023).

The findings of this study suggest that peppermint aromatherapy may be a useful complementary nursing intervention for managing chemotherapy-induced nausea and vomiting in breast cancer patients. Its application is relatively simple, non-invasive, and potentially inexpensive. However, peppermint aromatherapy should be considered a

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complementary intervention rather than a replacement for standard pharmacological antiemetic therapy. Further studies with larger sample sizes, control groups, and randomized designs are recommended to confirm its effectiveness and determine the optimal dosage, frequency, and duration of peppermint aromatherapy.

CONCLUSION

Peppermint aromatherapy was associated with a statistically significant reduction in nausea and vomiting scores among 20 breast cancer patients following chemotherapy at Dr. H. Abdul Moeloek Regional General Hospital. The mean score decreased from 7.30 ± 1.031 before the intervention to 5.80 ± 0.696 after the intervention, with a mean reduction of 1.50 points and a Wilcoxon signed-rank test result of $p < 0.001$. Peppermint aromatherapy may therefore be considered a complementary, non-invasive nursing intervention for symptom management, although the one-group design does not permit a definitive causal conclusion.

SUGGESTION

Peppermint aromatherapy may be incorporated as a complementary nursing intervention for patients experiencing nausea and vomiting after chemotherapy, while standard antiemetic treatment is maintained. Further research should involve larger samples, a control or comparison group, randomized allocation, standardized peppermint concentration and administration duration, and documentation of antiemetic medication and chemotherapy regimen.

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