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The Effect of Keraton Tea aromatherapy on Anxiety Levels Among Cancer Patients Undergoing Chemotherapy

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Abstract

Background: Cancer is one of the leading causes of morbidity and mortality worldwide. Patients undergoing chemotherapy experience not only various physical symptoms but also psychological problems, particularly anxiety, which may adversely affect their quality of life and treatment adherence. One complementary therapy that has the potential to reduce anxiety is Keraton Tea aroma therapy, which induces relaxation through stimulation of the olfactory system.

Aims: This study aimed to determine the effect of Keraton Tea aroma therapy on anxiety levels among cancer patients undergoing chemotherapy at Raden Mattaher National General Hospital, Jambi Province.

Methods: This study used a pretest–posttest control group design in a quasi-experimental manner. Using total sampling, 60 respondents who satisfied the inclusion criteria were gathered and divided into two groups: an intervention group (n = 30) and a control group (n = 30). The Hamilton Anxiety Rating Scale (HAM-A) was used to assess anxiety levels. The Wilcoxon Signed Rank Test and the Mann-Whitney U Test with a significance level of $\alpha = 0.05$ were used to evaluate the data.

Results: According to the findings, the majority of participants in the intervention and control groups 80.0% and 56.7%, respectively had mild anxiety before to the intervention. The percentage of individuals in the intervention group who experienced no anxiety rose from 3.3% to 23.3% after receiving Keraton Tea Aromatherapy, while the improvement in the control group was comparatively less. Both the intervention group ($Z = -4.468$; $p < 0.001$) and the control group ($Z = -2.032$; $p = 0.042$) showed a substantial decrease in anxiety levels before and after the intervention, according to the Wilcoxon signed-rank test. Prior to the intervention, there was no discernible difference in the two groups' baseline anxiety levels, according to the Mann-Whitney U test ($p = 0.129$). However, following the intervention, there were significant differences between the intervention and control groups in the change in anxiety scores (Δ = pretest – posttest) ($p < 0.001$), suggesting that the intervention group experienced a significantly higher reduction in anxiety than the control group.

Conclusion: For cancer patients receiving chemotherapy, Keraton Tea aromatherapy effectively lowers anxiety levels. This treatment could be viewed as an additional non-pharmacological nursing intervention to help reduce anxiety during chemotherapy.

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INTRODUCTION

Cancer continues to be a significant global public health issue, resulting in high rates of morbidity and mortality as well as a significant financial burden on patients, families, and healthcare systems (Bray et al., 2024; World Health Organization, 2021). Chemotherapy is now one of the most commonly used therapeutic modalities in oncology care due to advancements in cancer treatment. Chemotherapy seeks to prevent the growth of cancer cells, manage the course of the

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illness, and enhance survival rates (American Cancer Society, 2024; Hanahan, 2022). Despite its therapeutic benefits, chemotherapy is frequently associated with adverse effects such as nausea, vomiting, fatigue, alopecia, sleep disturbances, and uncertainty regarding treatment outcomes, all of which may contribute to psychological distress and anxiety (Bower, 2014; Vardy et al., 2022).

One of the most common psychological symptoms that cancer patients encounter is anxiety. Anxiety may negatively impact sleep quality, raise symptom burden, hinder day-to-day functioning, and ultimately lower quality of life, according to earlier research (Calvo-Schimmel et al., 2023; Papadopoulou et al., 2022). As a result, evidence-based integrative therapies are being used more frequently in supportive oncology care to help adult cancer patients manage their anxiety and depression symptoms (Carlson et al., 2023). Excessive fear, concern, and physiological arousal are the hallmarks of anxiety, which can disrupt daily activities and emotional functioning. Persistent anxiety during cancer treatment may negatively influence patients' coping ability and overall psychological well-being (American Psychiatric Association, 2022)

Psychological distress has been recognized as an essential component of comprehensive cancer care because it negatively affects treatment adherence, symptom burden, healthcare utilization, and overall quality of life. Consequently, international oncology guidelines recommend routine screening for emotional distress throughout the cancer care continuum. The National Comprehensive Cancer Network (NCCN) recommends the Distress Thermometer as a rapid and reliable screening tool for identifying patients who require further psychosocial assessment and supportive care. Early recognition of distress enables timely intervention, reduces psychological suffering, and facilitates more patient-centered oncology services (Kirsch et al., 2024; National Comprehensive Cancer Network, 2024).

The increasing number of patients receiving chemotherapy highlights the growing need for interventions that address not only physical symptoms but also psychological well-being. At Raden Mattaher Regional Hospital, Jambi Province, the number of chemotherapy visits increased from 105 patients in 2022 to 1,387 patients in 2023 and reached 2,699 patients in 2024 according to hospital medical records. This trend reflects the increasing demand for supportive interventions capable of helping patients cope with treatment-related psychological distress.

The therapeutic effects of inhaled aromatherapy are mediated through the olfactory-limbic pathway. Volatile aromatic compounds bind to olfactory receptors in the nasal epithelium and transmit sensory signals directly to the olfactory bulb and interconnected limbic brain structures, including the amygdala, piriform cortex, orbitofrontal cortex, and other regions involved in emotional and cognitive processing. These interconnected networks play important roles in emotional regulation, memory processing, and behavioral responses to sensory stimuli. Unlike most other sensory modalities, olfactory signals reach the limbic system without first passing through the thalamus, enabling odors to rapidly evoke emotional and physiological responses. This unique neuroanatomical organization provides a biological basis for the influence of olfactory stimulation on emotional processing and supports the investigation of inhaled aromatherapy as a complementary intervention for anxiety management among patients undergoing chemotherapy (Shanahan & Kahnt, 2022; Torske et al., 2022)

Within the framework of supportive and integrative oncology, evidence-based complementary interventions are increasingly incorporated alongside conventional cancer treatment to address the psychological and emotional needs of patients. Integrative approaches aim to reduce distress, anxiety, fatigue, sleep disturbances, and other treatment-related symptoms while improving psychological well-being and overall quality of life. As a non-pharmacological intervention with minimal adverse effects, inhaled aromatherapy represents one of the complementary therapies that may enhance emotional comfort and support holistic, patient-centered cancer care when used alongside standard oncology treatment (Carlson et al., 2023).

The National Cancer Institute also recognizes aromatherapy as one of the complementary therapies that may help improve emotional well-being and relieve anxiety-related symptoms in people with cancer. Although aromatherapy is not intended to replace conventional cancer treatment, it may provide supportive benefits when integrated into comprehensive oncology care (National Comprehensive Cancer Network, 2024). Consistent with these neurobiological mechanisms, a meta-analysis demonstrated that aromatherapy significantly reduces anxiety across various clinical populations, supporting its effectiveness as a safe complementary intervention for

psychological symptom management (Gong et al., 2020). Growing evidence supports the effectiveness of aromatherapy, with recent systematic reviews and meta-analyses demonstrating that aromatherapy significantly reduces anxiety among patients with cancer while improving psychological well-being and treatment-related distress (Ahn & Kim, 2024; Li et al., 2022)

Indonesia possesses a rich diversity of natural resources with potential application as culturally based aromatherapy interventions. One such resource is Keraton Tea, an aromatic tea prepared from Camellia sinensis leaves blended with jasmine flowers (Jasminum sambac), pandan leaves (Pandanus amaryllifolius), and selected traditional spices. In this study, Keraton Tea was used in the form of an essential oil and administered through an ultrasonic diffuser for inhalation aromatherapy. Three drops of Keraton Tea essential oil were diluted in 200 mL of water in the diffuser, allowing its aromatic compounds to be dispersed into the air and naturally inhaled by participants. This method was used to provide a floral, fresh, and soothing aroma that may promote psychological comfort and relaxation.

The potential therapeutic value of Keraton Tea is supported by the bioactive compounds contained within its ingredients. Camellia sinensis contains catechins, flavonoids, polyphenols, and L-theanine (Dippong et al., 2023). L-theanine has been shown to increase alpha brain-wave activity and modulate neurotransmitters associated with relaxation and emotional stability (Unno et al., 2020). Furthermore, jasmine flowers contain volatile compounds such as linalool, benzyl acetate, benzyl alcohol, and indole, which have demonstrated anxiolytic effects through olfactory stimulation and limbic system activation (Hedigan et al., 2023). These mechanisms may contribute to reduced sympathetic nervous system activity and improved emotional well-being among patients experiencing chemotherapy-related stress.

Although substantial evidence supports the effectiveness of aromatherapy in reducing anxiety, evidence regarding culturally based aromatherapy derived from Indonesian natural resources remains limited. Most previous studies have focused on lavender, bergamot, chamomile, peppermint, and other commercially available essential oils (Li et al., 2022; Malloggi et al., 2022). Therefore, this study aimed to determine the effect of Keraton Tea aromatherapy on anxiety levels among cancer patients undergoing chemotherapy at Raden Mattaher Regional Hospital, Jambi Province.

METHOD

This study employed a nonequivalent control group pretest–posttest design in a quantitative, quasi-experimental manner. From March to April of 2026, the study was carried out in the chemotherapy unit of Raden Mattaher Regional Hospital in Jambi Province. Keraton Tea aromatherapy was administered to the intervention group, while regular hospital treatment was given to the control group. Both groups' anxiety levels were assessed prior to and during the intervention. Seventy patients with colorectal, breast, and cervical cancer receiving outpatient treatment at the treatment Unit of Raden Mattaher Regional Hospital in Jambi Province made up the study population. A total of sixty respondents 30 in the intervention group and 30 in the control group met the eligibility criteria and took part in the study. The study protocol called for the systematic assignment of eligible respondents based on their arrival order, with even numbers going to the control group and odd numbers going to the intervention group.

The Hamilton Anxiety Rating Scale (HAM-A), which has 14 items encompassing both psychological and physical symptoms of anxiety, was used to collect data. The HAM-A scoring rules were used to classify anxiety ratings. An ultrasonic diffuser with three drops of Keraton Tea essential oil in 200 milliliters of water was used to deliver the aromatherapy intervention. Before chemotherapy, the diffuser was placed about two meters away from the respondent and ran for about fifteen minutes. The setting for the intervention was rather quiet and well-ventilated.

The degree of anxiety was measured using the Hamilton Anxiety Rating Scale (HAM-A), which was first created by Hamilton in 1959. The overall score ranges from 0 to 56, with each item receiving a value between 0 and 4. The tool is frequently employed in clinical research and evaluates both psychological and physical signs of anxiety. With clearance number S.257/SPE/III/2026 and research authorization number S.527/RSUD.2.1/III/2026, the Health Research Ethics Committee of Raden Mattaher Regional Hospital, Jambi Province, granted ethical

approval. Prior to data collection, each subject provided written informed consent. Throughout the study, participant anonymity and confidentiality were upheld.

RESULTS AND DISCUSSION

Results

Overview of the Mean Anxiety Level among Patients Before Receiving Keraton Tea Aromatherapy

The Hamilton Anxiety Rating Scale (HAM-A) was used to measure anxiety levels in both the intervention and control groups prior to the intervention. Table 1 shows the distribution of anxiety categories before to the intervention.

Table 1. Distribution of Anxiety Levels Before Intervention in the Intervention and Control Groups

Anxiety Level	Intervention (n=30)	Control (n=30)
No anxiety symptoms	1 (3.3%)	0 (0.0%)
Mild anxiety	24 (80.0%)	17 (56.7%)
Moderate anxiety	5 (16.7%)	10 (33.3%)
Severe anxiety	0 (0.0%)	3 (10.0%)
Total	30 (100.0%)	30 (100.0%)

According to Table 1, the majority of respondents in the intervention group had mild anxiety (80.0%) prior to the intervention, followed by moderate anxiety (16.7%) and no anxiety symptoms (3.3%). The majority of participants in the control group also reported having mild anxiety (56.7%), moderate anxiety (33.3%), and severe anxiety (10.0%). These results show that the majority of respondents had anxiety prior to the intervention.

Overview of the Mean Anxiety Level among Patients After Receiving Keraton Tea Aromatherapy

After the intervention and observation period, anxiety levels were reassessed using the Hamilton Anxiety Rating Scale (HAM-A). The distribution of anxiety categories after the intervention is presented in Table 2.

Table 2. Distribution of Anxiety Levels After Intervention in the Intervention and Control Groups

Anxiety Level	Intervention (n=30)	Control (n=30)
No anxiety symptoms	7 (23.3%)	1 (3.3%)
Mild anxiety	20 (66.7%)	18 (60.0%)
Moderate anxiety	3 (10.0%)	9 (30.0%)
Severe anxiety	0 (0.0%)	2 (6.7%)
Total	30 (100.0%)	30 (100.0%)

According to Table 2, the percentage of respondents in the intervention group who did not experience anxiety symptoms rose from 3.3% to 23.3% following Keraton Tea aromatherapy, whilst the percentage of respondents who had significant anxiety fell from 16.7% to 10.0%. Prior to and during the intervention, no respondent in the intervention group was classified as experiencing significant anxiety. The percentage of the control group that did not experience anxiety symptoms rose from 0.0% to 3.3%. While moderate anxiety dropped from 33.3% to 30.0% and severe anxiety dropped from 10.0% to 6.7%, mild anxiety rose from 56.7% to 60.0%. Overall, the categorical improvement was more pronounced in the intervention group than in the control group.

The Effect of Keraton Tea Aromatherapy on Anxiety Levels among Patients Undergoing Chemotherapy

The Wilcoxon Signed Rank Test was used to examine the variations in anxiety levels prior to and following the intervention. The Mann-Whitney U Test was used to examine differences between the intervention and control groups. Tables 3-5 show the outcomes.

Table 3. Results of the Wilcoxon Signed Rank Test in the Intervention Group

Anxiety Level	Before n (%)	After n (%)	Negative Rank (n)	Mean Rank	Ties	Z	p-value

No anxiety symptoms	1 (3.3%)	7 (23.3%)	26	13.50	4	−4.468	<0.001
Mild anxiety	24 (80.0%)	20 (66.7%)					
Moderate anxiety	5 (16.7%)	3 (10.0%)					
Severe anxiety	0 (0.0%)	0 (0.0%)					

The Wilcoxon Signed Rank Test yielded a Z value of −4.468 with $p < 0.001$ based on Table 3. As a result, the intervention group's anxiety levels before and after receiving Keraton Tea aromatherapy differed statistically significantly.

Table 4. Results of the Wilcoxon Signed Rank Test in the Control Group

Anxiety Level	Before n (%)	After n (%)	Negative Rank (n)	Mean Rank	Ties	Z	p-value
No anxiety symptoms	0 (0.0%)	1 (3.3%)	5	3.00	25	−2.032	0.042
Mild anxiety	17 (56.7%)	18 (60.0%)					
Moderate anxiety	10 (33.3%)	9 (30.0%)					
Severe anxiety	3 (10.0%)	2 (6.7%)					

The Wilcoxon Signed Rank Test yielded a Z value of −2.032 with $p = 0.042$ based on Table 4. As a result, even though the categorical changes were minimal, there was a statistically significant difference in the control group's anxiety levels before and after the observation period.

Table 5. Results of the Mann–Whitney U Test for Anxiety Scores Between the Intervention and Control Groups

Variable	Mean Rank Intervention	Mean Rank Control	Z	p-value
Pretest anxiety score	27.10	33.90	−1.517	0.129
Posttest anxiety score	18.98	42.02	−5.171	<0.001
Change in anxiety score (Δ)	41.80	19.20	−5.330	<0.001

Based on Table 5, the Mann–Whitney U Test showed no statistically significant difference in baseline anxiety between the intervention and control groups before the intervention ($Z = −1.517$; $p = 0.129$). After the intervention, there was a statistically significant difference in anxiety scores between the two groups ($Z = −5.171$; $p < 0.001$). The analysis of the change in anxiety scores (Δ = pretest − posttest) also showed a statistically significant difference between groups ($Z = −5.330$; $p < 0.001$). The mean rank for the change score was higher in the intervention group than in the control group (41.80 vs. 19.20), indicating a greater reduction in anxiety in the intervention group.

Discussion

Overview of the Mean Anxiety Level Among Cancer Patients Before Receiving Keraton Tea aromatherapy

The findings of this study showed that before receiving Keraton Tea aromatherapy, most respondents in the intervention group experienced mild anxiety (80.0%), followed by moderate anxiety (16.7%), while 3.3% had no anxiety symptoms. In the control group, 56.7% experienced mild anxiety, 33.3% moderate anxiety, and 10.0% severe anxiety. These findings indicate that anxiety was commonly experienced by cancer patients undergoing chemotherapy before treatment.

The findings of this study showed that before receiving Keraton Tea aromatherapy, most respondents in the intervention group experienced mild anxiety (80.0%), followed by moderate anxiety (16.7%), while 3.3% had no anxiety symptoms. In the control group, most respondents experienced mild anxiety (56.7%), followed by moderate anxiety (33.3%) and severe anxiety (10.0%).

This finding indicates that cancer patients undergoing chemotherapy commonly experience psychological distress before treatment. Anxiety before chemotherapy is a normal psychological response that arises from uncertainty regarding treatment outcomes, fear of chemotherapy side effects, disease progression, and concerns about survival. According to the Transactional Theory of Stress and Coping, anxiety develops when patients perceive that the demands posed by cancer treatment exceed their available coping resources. Consequently, patients tend to appraise chemotherapy as a threatening event that may affect both their physical condition and future quality of life (Lazarus, 1984).

Chemotherapy is one of the principal treatment modalities for cancer; however, it is frequently associated with unpleasant adverse effects such as nausea, vomiting, fatigue, alopecia, decreased appetite, peripheral neuropathy, and sleep disturbances. These anticipated and experienced side effects often increase patients' emotional burden and contribute to elevated anxiety before treatment sessions. Furthermore, repeated chemotherapy cycles may intensify anticipatory anxiety because patients remember previous unpleasant experiences during earlier treatment cycles (American Cancer Society, 2025; Hanahan, 2022).

The findings of this study are consistent with previous studies reporting that anxiety is one of the most common psychological problems experienced by patients undergoing chemotherapy. Several studies have demonstrated that uncertainty regarding treatment effectiveness, fear of disease progression, and concerns about adverse effects are major predictors of anxiety among oncology patients. Patients with higher anxiety levels often report poorer quality of life, lower treatment satisfaction, and decreased adherence to cancer therapy (Pitman et al., 2018; Sari et al., 2019). From a biopsychosocial perspective, anxiety experienced by cancer patients before chemotherapy results from the interaction of biological, psychological, and social factors. Biologically, the cancer diagnosis and anticipated physical discomfort activate physiological stress responses. Psychologically, patients frequently experience fear of death, uncertainty about prognosis, loss of independence, and concerns regarding body image changes caused by chemotherapy. Socially, reduced family income, interruption of employment, increased financial burden, and fear of becoming dependent on family members further contribute to psychological distress (Ilkhile et al., 2024; Smith et al., 2019).

In addition, many cancer patients experience emotional distress due to prolonged treatment duration and repeated hospital visits. Waiting for chemotherapy sessions, laboratory results, and medical evaluations may increase uncertainty and emotional tension. Some patients also express concern about becoming a burden to their families because chemotherapy often limits their ability to work and perform daily activities independently (Calderon et al., 2021; Leung et al., 2014). Based on observations conducted during the study, many respondents appeared nervous while waiting for chemotherapy. Several patients reported fear of experiencing nausea, vomiting, weakness, and pain following chemotherapy, particularly those who had previously undergone several treatment cycles. Other respondents expressed concerns about disease progression and uncertainty regarding treatment success. Family members accompanying patients also appeared anxious, indirectly influencing patients' emotional responses during hospital visits.

The researcher also observed that nursing care primarily emphasized physical preparation before chemotherapy, while psychological preparation and complementary nursing interventions to reduce anxiety had not been optimally integrated into routine clinical practice. Consequently, many patients entered the chemotherapy room without adequate relaxation techniques or emotional coping strategies, which may have contributed to their anxiety levels before treatment. Based on the findings of this study, supporting theories, previous research, and field observations, the anxiety experienced by cancer patients before chemotherapy can be explained through the interaction of biological, psychological, and social factors. Therefore, comprehensive oncology nursing care should not only focus on medical management but should also incorporate evidence-

based complementary interventions, such as Keraton Tea aromatherapy, to reduce anxiety, improve psychological well-being, and enhance patients' readiness to undergo chemotherapy.

Overview of the Mean Anxiety Level Among Cancer Patients After Receiving Keraton Tea aromatherapy

After the intervention, the distribution of anxiety categories in the intervention group showed an increase in respondents without anxiety symptoms from 3.3% to 23.3% and a decrease in moderate anxiety from 16.7% to 10.0%. In the control group, the proportion without anxiety symptoms increased only from 0.0% to 3.3%, while the changes in mild, moderate, and severe anxiety were relatively small. The findings of this study demonstrated an improvement in the distribution of anxiety categories after receiving Keraton Tea aromatherapy. In the intervention group, the proportion of respondents without anxiety symptoms increased from 3.3% to 23.3%, while moderate anxiety decreased from 16.7% to 10.0%. In the control group, the proportion without anxiety symptoms increased from 0.0% to 3.3%, while changes in the other categories were relatively small. These findings indicate a more pronounced improvement in the intervention group.

The reduction in anxiety observed in this study can be explained through the physiological mechanism of olfactory stimulation. Volatile aromatic compounds released from Keraton Tea, including those derived from *Camellia sinensis*, *Jasminum sambac*, *Pandanus amaryllifolius*, and traditional Indonesian spices, stimulate olfactory receptors in the nasal cavity. Sensory signals are then transmitted directly to the limbic system, particularly the amygdala and hippocampus, which regulate emotional processing, memory, and autonomic nervous system activity. Activation of these brain regions suppresses sympathetic nervous system activity while enhancing parasympathetic responses, thereby promoting relaxation and reducing anxiety (Choi et al., 2022; Liu et al., 2022).

In addition to its physiological effects, aroma therapy also influences psychological well-being by creating a calming sensory environment. Pleasant aromas can evoke positive emotional memories, increase perceptions of comfort and safety, and distract patients from anticipatory fears related to chemotherapy procedures. Consequently, patients may perceive chemotherapy as a more manageable experience, resulting in lower emotional distress and improved coping ability during treatment (Li et al., 2022; Malloggi et al., 2022). From the biopsychosocial perspective, these findings suggest that anxiety reduction is not solely attributable to biological responses but also reflects psychological adaptation during cancer treatment. The biopsychosocial model proposes that health outcomes are determined by the interaction of biological, psychological, and social factors rather than by physiological mechanisms alone (Borrell-Carrio, 2004; Engel, 1977). By decreasing anxiety, aroma therapy may improve emotional stability, enhance patients' confidence in undergoing chemotherapy, and facilitate more adaptive coping with the challenges associated with cancer treatment.

The findings of this study are consistent with previous research demonstrating that aroma therapy is an effective complementary intervention for reducing anxiety among oncology patients. A systematic review and meta-analysis by Li et al., (2022) concluded that inhaled aroma therapy significantly reduced anxiety and depression among patients with cancer while improving overall psychological well-being. Similarly, Farahani et al., (2019) reported that aroma therapy effectively alleviated anxiety and several treatment-related symptoms, supporting its use as a safe, non-pharmacological complementary intervention in oncology care. Overall, the present findings indicate that Keraton Tea aromatherapy has the potential to improve the psychological condition of patients undergoing chemotherapy. Although it does not replace standard medical treatment, this complementary intervention may provide additional emotional support, promote relaxation, and contribute to a more positive treatment experience. Therefore, integrating culturally appropriate aroma-based complementary therapies into routine oncology nursing care may enhance holistic patient management and improve quality of life during chemotherapy.

The Effect of Keraton Tea aromatherapy on Anxiety Levels Among Cancer Patients Undergoing Chemotherapy

The results of this study showed that among cancer patients receiving chemotherapy, Keraton Tea aromatherapy was linked to a statistically significant reduction in anxiety levels. In the

intervention group, the Wilcoxon Signed Rank Test revealed $Z = -4.468$ with $p < 0.001$. The posttest anxiety scores and the change in anxiety levels between the intervention and control groups were likewise significantly different, according to the Mann-Whitney U Test ($p < 0.001$). The physiological mechanism of olfactory stimulation explains the efficacy of Keraton Tea aromatherapy. Olfactory receptors in the nasal cavity are stimulated by aromatic chemicals emitted from Keraton Tea, especially volatile components derived from Camellia sinensis, Jasminum sambac, Pandanus amaryllifolius, and traditional Indonesian spices. The limbic system, particularly the amygdala and hippocampus, which are brain areas in charge of controlling emotions, memory, and autonomic nervous system activity, receives these sensory signals directly. By increasing parasympathetic nervous system activity and decreasing sympathetic nervous system activity, activation of these structures facilitates relaxation and reduces emotional stress and anxiety (Li et al., 2022; Malloggi et al., 2022).

In addition to its pleasant aroma, Keraton Tea may provide anxiolytic effects through its naturally occurring bioactive constituents, particularly L-theanine. L-theanine readily crosses the blood–brain barrier and has been shown to increase alpha-wave activity while modulating gamma-aminobutyric acid (GABA), dopamine, and serotonin neurotransmission. These neurophysiological changes promote relaxation, reduce psychological stress, and improve emotional stability without causing sedation. Furthermore, L-theanine has been associated with attenuation of cortisol secretion and improved autonomic regulation, which may further contribute to anxiety reduction among patients awaiting chemotherapy (Unno et al., 2020).

From a neurophysiological perspective, pleasant aromas stimulate the release of several neurotransmitters associated with emotional well-being, including serotonin, dopamine, gamma-aminobutyric acid (GABA), and endorphins. These neurochemical changes help suppress excessive hypothalamic-pituitary-adrenal (HPA) axis activation, resulting in lower cortisol secretion and improved emotional regulation. As a result, both before and during chemotherapy, patients report feeling at ease, peaceful, and less afraid (Hwang & Shin, 2015; Vora et al., 2024). The results of this study are in line with earlier research showing that aromatherapy is a useful supplemental strategy for lowering anxiety in cancer patients. By enhancing emotional comfort and lowering psychological discomfort, inhaled aromatherapy dramatically reduces anxiety both before and during chemotherapy, according to a number of systematic studies and meta-analyses. These findings suggest that aromatherapy may serve as a safe and effective non-pharmacological intervention to complement standard oncology care (Ahn & Kim, 2024; Farahani et al., 2019).

Furthermore, previous clinical studies have reported that patients receiving aromatherapy before chemotherapy showed lower anxiety scores, improved relaxation, and greater emotional stability compared with patients receiving routine care alone. Aromatherapy has also been associated with improvements in sleep quality, mood, and overall quality of life, supporting its role as an evidence-based complementary therapy in cancer care (Li et al., 2022)

From the biopsychosocial perspective, the reduction in anxiety observed after Keraton Tea aromatherapy reflects the interaction of biological, psychological, and social mechanisms. Biologically, pleasant aromas modulate autonomic nervous system function and reduce physiological stress responses. Psychologically, aromatherapy creates feelings of safety, comfort, and emotional relaxation, helping patients reinterpret chemotherapy as a manageable experience rather than an overwhelming threat. Socially, reduced anxiety enables patients to communicate more openly with family members and healthcare professionals, thereby strengthening coping resources during cancer treatment (Borrell-Carrio, 2004; Choi et al., 2022; Engel, 1977; Li et al., 2022).

Based on observations conducted during the study, respondents appeared noticeably calmer after receiving Keraton Tea aromatherapy. Patients waiting for chemotherapy demonstrated reduced facial tension, appeared more relaxed, and interacted more comfortably with nurses and accompanying family members. Several respondents reported that the aroma produced feelings of freshness, comfort, and emotional calmness while waiting for chemotherapy. Others stated that inhaling the aroma helped distract them from fears regarding chemotherapy side effects, including nausea, vomiting, fatigue, and pain.

The researcher also observed that administering aromatherapy approximately 15–30 minutes before chemotherapy created a more comfortable treatment environment. Patients

appeared more cooperative during nursing procedures and expressed greater psychological readiness to undergo chemotherapy. These observations suggest that the intervention not only reduced anxiety scores but also improved patients' overall emotional preparedness before treatment. Nevertheless, several respondents demonstrated only modest reductions in anxiety scores following the intervention. This finding may be explained by factors beyond the effects of aromatherapy, including cancer stage, previous chemotherapy experience, severity of treatment-related adverse effects, family support, financial concerns, personality characteristics, and individual coping abilities. These variables may continue to influence patients' emotional responses despite receiving complementary interventions.

Overall, the findings indicate that Keraton Tea aromatherapy is an effective complementary nursing intervention for reducing anxiety among cancer patients undergoing chemotherapy. Its therapeutic effects are achieved through interconnected neurophysiological and psychological mechanisms involving olfactory stimulation, autonomic nervous system regulation, and emotional processing within the limbic system. As a result, patients become calmer, demonstrate better emotional control, and show greater readiness to undergo chemotherapy.

These findings have important implications for oncology nursing practice. Keraton Tea aromatherapy may be incorporated as a simple, safe, inexpensive, and culturally appropriate complementary nursing intervention within chemotherapy units. Because the therapy is easy to administer, non-invasive, and requires minimal equipment, nurses can integrate it into routine pre-chemotherapy care to improve patients' psychological well-being. The incorporation of Keraton Tea aromatherapy into supportive cancer care has the potential to reduce anxiety, strengthen patients' coping abilities, improve treatment experiences, and ultimately contribute to better adherence to chemotherapy and enhanced quality of life.

Implications

The findings of this study have implications for nursing practice and supportive cancer care. Keraton Tea aromatherapy may be considered as a simple, non-invasive, and culturally based complementary intervention to help reduce anxiety among patients undergoing chemotherapy. Its use through an ultrasonic diffuser may be incorporated into nursing care with appropriate standard operating procedures and consideration of patient comfort and environmental conditions. Further research with larger samples, longer follow-up periods, and standardized formulations of Keraton Tea essential oil is recommended to strengthen the evidence regarding its effectiveness and applicability in clinical practice.

Research contribution

The present findings are consistent with current international oncology recommendations emphasizing that supportive and palliative care should be integrated throughout the cancer care continuum. In addition to symptom management, supportive interventions should address psychological well-being and improve patients' quality of life during active cancer treatment (Sanders et al., 2024). The findings of this study add value to the field of nursing, particularly in oncology nursing practice and the psychological management of cancer patients undergoing chemotherapy. The findings provide empirical evidence that Keraton Tea aromatherapy can significantly reduce anxiety levels among cancer patients receiving chemotherapy. This study also supports the role of nurses in providing holistic and patient-centered care. Nursing care should not only focus on chemotherapy administration, symptom management, and the treatment of physical complications. It should also address the psychological problems experienced by patients, particularly anxiety, throughout the chemotherapy process. Furthermore, this study introduces Keraton Tea, a culture-based Indonesian aromatherapy, as a potential complementary nursing intervention that is simple, safe, affordable, and easy to implement in clinical settings. The outcomes of this research may also serve as a useful reference for future studies investigating the effectiveness of complementary and non-pharmacological interventions for anxiety management among cancer patients undergoing chemotherapy and other patients with chronic illnesses.

Limitations

This study has several limitations. First, the study was conducted in a single chemotherapy unit with a relatively modest sample size, which may limit the generalizability of the findings to other cancer populations and healthcare settings. Second, the intervention was administered for approximately 15 minutes, and the study did not assess the longer-term effects of Keraton Tea aromatherapy on anxiety. Third, although the intervention procedure was standardized, individual differences in patients' responses to aroma and variations in the treatment environment may have influenced anxiety outcomes. Finally, the study focused on patients with breast, cervical, and colorectal cancer undergoing outpatient chemotherapy; therefore, the findings may not be directly generalizable to patients with other cancer types or treatment settings. Further multicenter studies with larger sample sizes and longer follow-up periods are needed to confirm and extend these findings.

Suggestions

Hospitals and chemotherapy units are expected to incorporate Keraton Tea aromatherapy into routine nursing care as a complementary intervention for cancer patients undergoing chemotherapy. This program may include patient education about anxiety management, demonstration of the appropriate use of Keraton Tea aromatherapy before chemotherapy, written or audiovisual instructions, and regular evaluation by nurses to monitor patients' psychological responses. Nurses should provide initial guidance to ensure that patients receive the aromatherapy correctly and consistently. Family members should also be involved because they can encourage, remind, and support patients in using Keraton Tea aromatherapy before chemotherapy sessions or during periods of anxiety at home. Further studies are recommended to include a control group, recruit a larger sample size, and evaluate the long-term effectiveness of Keraton Tea aromatherapy across different types and stages of cancer. These improvements are needed to provide stronger scientific evidence regarding the effectiveness of Keraton Tea aromatherapy as a complementary nursing intervention for reducing anxiety among cancer patients undergoing chemotherapy.

CONCLUSION

The majority of respondents in the intervention and control groups were categorized as experiencing mild anxiety (80.0% and 56.7%, respectively), indicating that cancer patients undergoing chemotherapy frequently experience anxiety prior to treatment. The percentage of respondents in the intervention group who did not experience anxiety symptoms rose from 3.3% to 23.3% following Keraton Tea aromatherapy. Additionally, following the intervention, there were significant differences between the intervention and control groups in the change in anxiety levels ($p < 0.001$), suggesting that the intervention group experienced a bigger reduction in anxiety.

The findings suggest that Keraton Tea aromatherapy may be considered a safe, simple, affordable, and culturally appropriate complementary nursing intervention for oncology care. By promoting relaxation through olfactory stimulation and emotional regulation, this intervention has the potential to enhance patients' psychological well-being, improve readiness for chemotherapy, and support the delivery of holistic, patient-centered nursing care. Therefore, integrating Keraton Tea aromatherapy into routine pre-chemotherapy nursing practice may contribute to better psychological outcomes and an improved overall treatment experience for cancer patients.

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AUTHOR CONTRIBUTION STATEMENT

JP developed the research concept, collected data, analyzed data, and prepared the manuscript. KI supervised the research design, interpretation of findings, and critical revision of the manuscript. CIHP supported the methodology, data interpretation, and manuscript refinement. All authors reviewed and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The authors declare that there are no financial, commercial, institutional, or personal relationships that could have influenced the design, implementation, analysis, interpretation, or reporting of this study. The authors received no sponsorship or financial support from any manufacturer, distributor, or commercial organization related to Keraton Tea or aromatherapy products.

The authors are solely responsible for the content of this manuscript and confirm that the research was conducted in accordance with scientific and ethical principles. All data presented in this study are original, accurately reported, and have not been fabricated, falsified, or manipulated. The authors further declare that this manuscript has not been published previously and is not under consideration for publication elsewhere.

CONFLICTS OF INTEREST

The authors state that there are no financial, institutional, personal, or professional conflicts of interest that may affect the implementation of this study, data analysis, manuscript preparation, or publication process.

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