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Sistemik Derleme / Systematic Review

The Impact of Aromatherapy on Symptom Management among Pediatric Hematology and Oncology Patients: A Systematic Review

Pediyatrik Hematoloji ve Onkoloji Hastalarında Semptom Yönetiminde Aromaterapinin Etkisi: Sistemik Derleme

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ABSTRACT

Aim: The study proposed to systematically review, evaluate, and summarize the impact of aromatherapy in managing symptoms for pediatric hematology and oncology patients.

Material and Method: Researchers thoroughly searched six academic databases, covering studies from the inception of each database up to July, 2024, without applying any restrictions on the starting year. The following criteria were included: studies involving pediatric oncology patients, those utilizing aromatherapy, a focus on managing symptoms, and publication in the English language. The review followed PRISMA guidelines and was registered in PROSPERO under the ID CRD42024577088.

Results: Eight studies were included in this systematic review. Three focused on chemotherapy-induced nausea and vomiting, one on sleep disorders, and one on both chemotherapy-induced nausea and vomiting and quality of life. One study focused on chronic pain, and the final study focused on nausea, pain, and mood. Peppermint and mint-lemon reduced chemotherapy-induced nausea and vomiting, orange oil improved sleep, and patient-selected oils improved pain management.

Conclusion: The focus of the study was to evaluate how effectively aromatherapy could manage treatment-related symptoms in children undergoing cancer treatment. Although study quality varied, the findings indicate that aromatherapy shows promise as a tool for symptom management in this context.

Keywords: Aromatherapy, Symptom management, Pediatric, Oncology, Review

ÖZET

Amaç: Bu çalışmanın amacı, pediyatrik hematoloji ve onkoloji hastalarında semptomların yönetiminde aromaterapinin etkilerine ilişkin kanıtları sistemik olarak gözden geçirmek, değerlendirmek ve özetlemektir.

Gereç ve Yöntem: Araştırmacılar, Temmuz 2024'e kadar olan çalışmalarını, başlangıç yılına ilişkin herhangi bir kısıtlama uygulamadan, kapsayan altı akademik veritabanında bir inceleme gerçekleştirdi. Çalışmalara yönelik dahil etme kriterleri şunlardı: pediyatrik onkoloji hastalarını içermesi, aromaterapi kullanımı, semptom yönetimine odaklanması, İngilizce dilinde olması ve hakemli dergilerde yayınlanmış olması. Bu sistemik inceleme PRISMA yönergelerine göre yürütülmüştür ve PROSPERO'ya (ID: CRD42024577088) kaydedilmiştir.

Bulgular: Bu sistemik incelemeye sekiz çalışma dahil edilmiştir. Üçü kemoterapiye bağlı bulantı ve kusmaya, biri uyku bozukluklarına, biri ise hem kemoterapiye bağlı bulantı ve kusmaya hem de yaşam kalitesine odaklanmıştır. Bir çalışma kronik ağrıya, son çalışma ise bulantı, ağrı ve ruh haline odaklanmıştır. Nane ve nane-limon kemoterapiye bağlı bulantı ve kusmayı azaltmıştır, portakal yağı uykuyu iyileştirmiştir ve hastalar tarafından seçilen yağlar ağrı yönetimine katkı sağlamıştır.

Sonuç: Çalışma, pediyatrik onkoloji hastalarında ağrı, bulantı, kusma ve diğer semptomların yönetiminde aromaterapinin etkinliğini incelemiştir. Çalışma kalitesindeki farklılıklara rağmen, bulgular aromaterapinin bu alanda semptom yönetimi için umut verici bir araç olduğunu göstermektedir.

Anahtar Kelimeler: Aromaterapi, Semptom yönetimi, Pediatri, Onkoloji, Derleme



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INTRODUCTION

Aromatherapy is a type of complementary and alternative medicine (CAM) that uses essential oils from plants to enhance both physical and emotional well-being (Bagetta et al., 2015). Aromatherapy has been widely used and acknowledged as a therapeutic practice since ancient times due to its pharmacological and psychological benefits, serving as a healing approach for the body, mind, and spirit (Soares et al., 2021). Numerous studies and clinical observations have shown that essential oils, such as bergamot, lemon, and lavender, effectively reduce stress, anxiety, pain, nausea, vomiting, depression, and other related conditions (Corasaniti et al., 2023; Schneider et al., 2019; Scuteri et al., 2021). These oils are typically inhaled or applied to the skin, allowing their aromatic compounds to engage with the body's systems (Baptista-Silva et al., 2020). The primary mechanism of aromatherapy involves the olfactory system, where inhaled aromatic molecules stimulate olfactory nerve cells, sending signals to the brain's limbic system (Angelucci et al., 2014). The limbic system, responsible for emotions, memory, and arousal, reacts by releasing neurotransmitters such as serotonin and endorphins, which can relieve pain, reduce emotional distress, and promote overall well-being (Evans et al., 2018; Triana et al., 2022; Weaver et al., 2020). The National Institutes of Health recognize aromatherapy as a safe and cost-effective complementary and alternative medicine, and meta-analyses and systematic reviews have demonstrated its usefulness in treating numerous medical ailments (Momani & Berry, 2017; Schneider et al., 2019).

One of the conditions in which aromatherapy is often used is symptom management of pediatric hematology and oncology diseases (Erdem et al., 2020). Lüthi et al. (2021) used CAM by 54.3% of pediatric oncology patients before diagnosis, 69.3% after diagnosis, and more than 10% used aromatherapy. Erdem et al. (2020) stated that more than half of the mothers of Turkish pediatric oncology patients (53.6%) were using CAM methods, and 10.9% of them used aromatherapy (black cumin oil). In pediatric hematology and oncology, children often endure severe and persistent symptoms as a result of their disease and the intensive treatments they undergo. Aromatherapy has been employed in pediatric hematology and oncology settings to address

several symptoms. These symptoms include chronic pain, nausea, anxiety, and sleep disturbances, which can severely impact their quality of life (QoL) (Evans et al., 2018; Şancı et al., 2023; Triana et al., 2022; Weaver et al., 2020). Traditional pharmacologic treatments, while effective, often come with significant side effects, prompting the exploration of non-pharmacologic interventions like aromatherapy to help manage these symptoms (Badr et al., 2024a). Essential oils like lavender and peppermint have been found to possess analgesic properties that can help reduce pain. Inhalation of these oils can lead to the release of endorphins, providing a natural pain relief mechanism (Triana et al., 2022; Weaver et al., 2020). Additionally, chemotherapy-induced nausea and vomiting (CINV) are common problems in pediatric oncology patients, and essential oils such as peppermint and ginger have antiemetic properties that may help reduce the occurrence and intensity of these symptoms (Evans et al., 2018; Momani & Berry, 2017; Toniolo et al., 2021). Studies have shown that aromatherapy can decrease the need for antiemetic medications and improve overall comfort (Evans et al., 2018; Triana et al., 2022). The calming effects of specific essential oils can facilitate reduced anxiety in pediatric patients (Lizarraga-Valderrama, 2021; Weaver et al., 2020). Aromatherapy affects the amygdala and hippocampus in the brain, which are involved in emotional regulation, promoting relaxation, and reducing stress levels (Lizarraga-Valderrama, 2021; Weaver et al., 2020). Aromatherapy can also improve sleep quality in pediatric patients (Shahidi et al., 2019).

Despite the promising benefits of aromatherapy, its application in pediatric oncology is still relatively under-researched. Existing studies, such as those by Triana et al. (2022) and Weaver et al. (2020), highlight the potential of aromatherapy in managing symptoms like chronic pain, nausea, and anxiety. Still, additional research is required to confirm these findings and develop standardized protocols. (Evans et al., 2018; Triana et al., 2022; Weaver et al., 2020). This systematic review was necessary to consolidate the existing evidence on the efficacy of aromatherapy in pediatric hematology and oncology settings. This review thoroughly examines how aromatherapy can be incorporated into symptom management for pediatric oncology and hematology patients by synthesizing findings

from multiple studies. The aim is to identify gaps in the existing research and propose areas for future investigation, with the ultimate aim of guiding healthcare professionals in implementing evidence-based aromatherapy practices to increase the quality of life for young oncology and hematology patients.

Research Questions

1. What is the effectiveness of aromatherapy interventions in symptom management of pediatric hematology and oncology patients?

MATERIAL AND METHODS

Study Design

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (Moher et al., 2009; Page & Moher, 2017). Additionally, the review was registered with the International Prospective Register of Systematic Reviews (PROSPERO) under the ID: CRD42024577088.

Search Strategy

The process started by identifying keywords through systematic reviews and input from two researchers with relevant expertise. These keywords were then thoroughly revised in collaboration with an expert librarian. The librarian conducted an extensive literature search across multiple databases, including Cochrane, Scopus, Medline, WOS, PubMed, and CINAHL. Relevant studies were identified from the inception of each database up to July 2024 without applying any restrictions on the starting year.

The keywords used in the search strategy included: ("Pediatrics"[Mesh] OR "pediatric" OR "pediatr*" OR "child" OR "children" OR "pediatrics" OR "Child"[Mesh]) AND ("Neoplasms"[Mesh] OR "cancer" OR "neoplasm" OR "Oncology Service, Hospital"[Mesh] OR "oncology service" OR "oncology" OR "Hematology"[Mesh] OR "hematology") AND ("Aromatherapy"[Mesh] OR "Aromatherapy" OR "aroma therapy" OR "aroma therapies" OR "Lavandula"[Mesh] OR "lavender" OR "Lavandula" OR "lemon" OR "Zingiber officinale"[Mesh] OR "ginger" OR "Oils, Volatile"[Mesh] OR "Volatile Oil" OR "Essential Oil") AND ("Anxiety"[Mesh] OR "anxiety" OR "Angst" OR "Nausea"[Mesh] OR "nausea" OR "Pain"[Mesh] OR "pain" OR "Affect"[Mesh] OR "affect" OR "mood" OR "Vomiting"[Mesh] OR "vomiting" OR "emesis").

Eligibility Criteria

The selection of studies for our review was guided by predefined inclusion and exclusion criteria based on the PICOS framework (Population, Intervention, Comparison, Outcomes, and Study design) (Frandsen et al., 2020).

- **Population (P):** Pediatric hematology and oncology patients
- **Intervention (I):** Aromatherapy
- **Comparison (C):** Both studies with and without a comparison group were considered
- **Outcomes (O):** Symptom management
- **Study Design (S):** Randomized controlled trials, quasi-experimental studies, feasibility studies, and pilot studies.

Studies were excluded if they focused on adult patients, investigated aromatherapy in combination with other complementary therapies without isolating its effects, or lacked sufficient data on symptom management outcomes. Additionally, reviews, case reports, editorials, conference abstracts, and opinion papers were excluded. Studies published in languages other than English were not considered.

Study Selection

The data was managed using Endnote 20, a reference management program. The authors initially assessed all titles and abstracts to ensure they met the previously specified eligibility criteria. The data was thoroughly examined to guarantee accuracy and consistency. Any differences were settled by agreement on the best way. Following that, the two authors implemented a preliminary evaluation of the full article. During the full-text investigation, two team members independently assessed each article to ensure that it matched the qualifying requirements. Articles that both authors recognized did not satisfy the criteria were excluded. In situations of disagreement, the team addressed their differences and came to an agreement to handle the issue. The screening process and the results of the study selection were meticulously documented and presented using a PRISMA flowchart, ensuring transparency and compliance with PRISMA guidelines (Figure 1).

Data Extraction

The authors evaluated the articles' eligibility using predefined criteria and quality assessment tools. The review process is illustrated in the

PRISMA in Figure 1. A total of 349 articles were initially identified from seven databases, and after removing 72 duplicates, 277 articles were retained for further screening. After the research' abstracts and titles were examined, 262 articles that had nothing to do with the study's main objective were eliminated. The full-text versions of the remaining 15 articles were then retrieved and assessed for relevance. After a thorough evaluation, seven articles were excluded for not meeting the inclusion criteria, leaving eight articles deemed suitable and included in the systematic review.

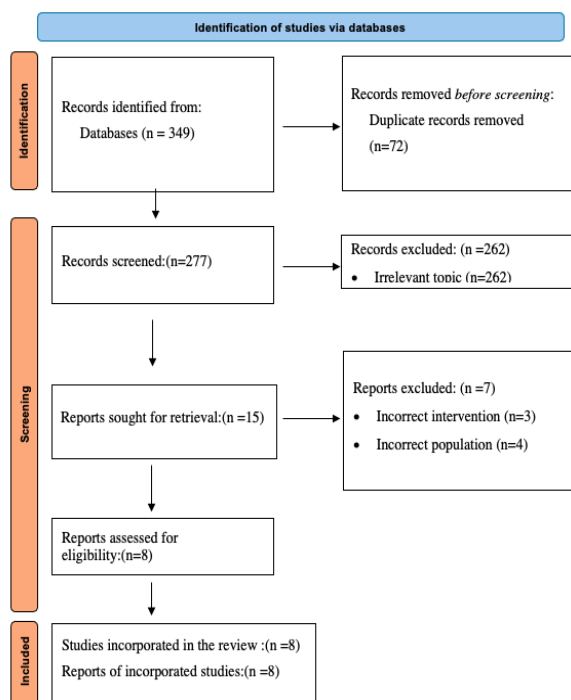


Figure 1. PRISMA flow diagram

The Assessment of Studies' Risk of Bias

The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Systematic Reviews and Research Syntheses was used to assess the quality of the included studies. JBI's critical appraisal tool for randomized controlled trials (RCTs) (Barker et al., 2023), while the JBI critical appraisal tool was used for quasi-experimental studies (Barker et al., 2024). The JBI critical appraisal tool for RCTs consists of 13 questions, and the tool for quasi-experimental studies includes nine questions. For RCTs, each question was rated as met (yes), unmet (no), unclear, or not applicable, with the same scoring system applied to quasi-experimental studies. Every study was evaluated by the two authors in turn, and each was given a risk of bias rating. Methodological quality

assessment of the included studies was carried out in a session with the participation of the first (ES) and second (RSŞ) researcher. If a question on the tool was answered with 'Yes,' it received a score of 1, while 'No' or 'Not Applicable' received a score of 0. The overall score for each paper was calculated as a percentage, with quality ratings categorized as good (80%–100%), moderate (50%–79%), or low (<50%).

Data Synthesis

Two independent researchers collected data using a standardized form that captured key details, including 1) author, year, and country of the study; 2) study type; 3) study sample; 4) type of aromatherapy; 5) type of symptom addressed; 6) application procedure; and 7) feasibility or validation results. To aid in data synthesis and the integration of research evidence, data extraction tables were utilized alongside the PICO elements of each study to categorize the findings. During the data synthesis process, the results of the included studies were thoroughly examined.

Data Analysis

Due to the heterogeneity of study designs, populations, aromatherapy methods, and outcome data, a meta-analysis was not possible. Due to the varied research types included in the research, a descriptive analysis method was used. Study findings were then summarized using descriptive analysis techniques (Table 1).

RESULTS

The Features of Studies

349 articles were initially found using the search method. Following eliminating duplicates, 277 papers underwent screening based on their titles and abstracts, resulting in a selection of just 15 articles for additional assessment. Seven studies were eliminated after this evaluation because the requirements for inclusion were not suitable. Of these, eight studies were included in this review; three more did not involve aromatherapy intervention, and four were eliminated because they focused on populations other than pediatrics. Table 1 lists the attributes of the articles that were included, and Figure 1 shows how the studies were identified and selected.

Table 1. The features of studies

Author, year, and country	Design	Population	Aromatherapy	Symptom	Application Procedure	Conclusion
Badr et al., 2024a, Egypt	Quasi-experimental	50 children diagnosed with leukemia aged 6-15 years	Peppermint	CINV	Instructing the child to take three breaths of the essence that had been placed on a piece of cotton	Peppermint inhalation may be effective in relieving CINV in children with leukemia.
Badr et al., 2024b, Egypt	RCT	75 children diagnosed with leukemia aged 6-12 years	Peppermint	CINV	Instructing the child to take three breaths of the essence that had been placed on a piece of cotton	Peppermint inhalation may offer notable antiemetic effects, helping to relieve CINV in children with leukemia.
Renani et al., 2023, Iran	Quasi-experimental	30 children diagnosed with ALL aged 6-12 years	Orange Essential Oil	Sleep Disturbance	Apply two drops of orange essential oil to a piece of gauze, hold it 2 inches away from the child's nose, and then place the gauze under the child's pillow.	Orange essential oil may help improve sleep disturbances in children with ALL.
Şancı et al., 2023, Türkiye	RCT	90 children diagnosed with leukemia aged 2-12 years	Peppermint-lemon	CINV and QoL	Through a diffuser	Mint and lemon aromatherapy can serve as an alternative method to enhance the quality of life for leukemia patients.
Triana et al., 2022, Indonesia	Pilot study/ Quasi-experimental	20 children with cancer aged 7-17 years	Essential oil selected by participant (most favourite aromatherapy was reported as Aloe Vera)	Chronic Pain	Drop 4 drops of the chosen essential oil onto a clean gauze and place it 20 cm away from the patient's chest.	Inhalation aromatherapy applications are a viable option for the management of chronic pain in young patients.
Weaver et al., 2019, USA	Pilot study	180 pediatric palliative care patients aged 4-17 years	Aromatherapy interventions included ginger, cardamom, spearmint, and fennel for nausea relief, while lavender, orange, juniper berry, patchouli, and ylang-ylang were used for promoting calm.	Nausea, pain, and mood	Via aromatherapy sachets	Aromatherapy can be a supportive intervention for pediatric patients undergoing palliative care.
Evans et al., 2018, USA	RCT	49 children with cancer aged 8-21 years	Ginger	CINV	Each child was instructed to take three deep breaths of the scent from the cup.	While ginger aromatherapy was well-received, well-tolerated, non-toxic, and non-invasive, it did not result in a significant reduction in nausea among the study participants.
Ndao et al., 2012, USA	RCT	37 pediatric patients aged 5-21 years undergoing stem cell infusion	Bergamot	Anxiety, nausea, and pain	Through a diffuser	Inhalation aromatherapy did not have any significant impact on reducing anxiety, nausea, or pain.

CINV: Chemotherapy-induced nausea and vomiting, ALL: Acute lymphoblastic leukemia

The evaluation examined studies performed from 2012 and 2024 (Figure 2). Three studies took place in the United States, two in Egypt, one in Türkiye, one in Indonesia, and one in Iran. Among the eight studies, four were randomized controlled trials (RCTs), three were quasi-experimental, and one employed a pilot study design. The overall sample size among the studies that comprised the current systematic review was 531 individuals, all of whom had been diagnosed with cancer, with the majority having acute lymphoblastic leukemia (ALL). Participant characteristics varied across the studies, including age, diagnosis, and treatment stages. Six studies focused on children and adolescents, while two included children, adolescents, and young adults. Most studies involved participants diagnosed with cancer, except for one study that included children with both malignant and non-malignant conditions and another that involved pediatric palliative care patients.

The Impact of Interventions

All the studies included in the review aimed to assess the effectiveness of aromatherapy in managing symptoms among pediatric oncology patients. Three of these studies focused on CINV (Badr et al., 2024a; Badr et al., 2024b; Evans et al., 2018), one addressed sleep disturbances (Renani et al., 2023), one examined both CINV and QoL (Şancı et al., 2023), one focused on chronic pain (Triana et al., 2022), and the final study investigated nausea, pain, and mood (Weaver et al., 2020). Additionally, one study evaluated the effects of aromatherapy on anxiety, nausea, and pain (Ndao et al., 2012).

Nausea and Vomiting

Six studies focused on evaluating the effectiveness of aromatherapy for CINV. Badr et al. (2024a) and Badr et al. (2024b) conducted studies using peppermint aromatherapy, demonstrating significant antiemetic effects in children with leukemia. Şancı et al. (2023) also investigated chemotherapy-induced nausea, discovering that inhalation aromatherapy with peppermint-lemon significantly managed CINV in children with leukemia. Weaver et al. (2020) investigated nausea using various aromatherapy sachets tailored for specific symptoms, finding that aromatherapy is a viable supportive care intervention for pediatric palliative care patients. Evans et al. (2018) explored ginger aromatherapy for CINV; while the intervention was well-received, it did not significantly decrease nausea

symptoms in the study's participants. Finally, Ndao et al. (2012) explored the effects of bergamot aromatherapy on nausea in pediatric patients undergoing stem cell infusion, but they did not report significant benefits from the intervention.

Pain

Some studies focused on evaluating the effectiveness of aromatherapy for pain management in pediatric oncology patients. Triana et al. (2022) addressed chronic pain management through participant-selected essential oils, with Aloe Vera being the most favored. The study suggested that inhaled aromatherapy could effectively control chronic pain in pediatric cancer patients. Weaver et al. (2020) investigated various aromatherapy sachets for nausea and other combinations for pain distraction. The study concluded that aromatherapy is a viable supportive care intervention for managing pain in pediatric palliative care patients. Ndao et al. (2012) explored the effects of bergamot aromatherapy on pain in pediatric patients undergoing stem cell infusion. However, the study did not report significant benefits of the aromatherapy intervention in reducing pain.

Other Symptoms

Several of the included studies assessed the effectiveness of aromatherapy in managing symptoms such as mood, anxiety, quality of life (QoL), and sleep disturbances in pediatric oncology patients. Weaver et al. (2020) examined the use of various aromatherapy sachets designed to improve mood, finding that aromatherapy can serve as a beneficial supportive care intervention in pediatric palliative care, with positive effects on mood. Ndao et al. (2012) evaluated the impact of bergamot aromatherapy on anxiety in pediatric patients undergoing stem cell infusion, though the trial did not find significant reductions in anxiety symptoms. Şancı et al. (2023) investigated the use of peppermint-lemon aromatherapy through a diffuser to enhance QoL in children with leukemia, concluding that this approach could be an alternative strategy to improve their quality of life. Finally, Renani et al. (2023) focused on sleep disturbances and found that orange essential oil significantly improved sleep quality in hospitalized children with acute lymphoblastic leukemia (ALL).

Aromatherapy Application Methods

Two studies used diffusers to deliver aromatherapy interventions (Ndao et al., 2012; Şancı et al., 2023), while others employed different methods. Badr et al. (2024a) and Badr et al. (2024b) used peppermint aromatherapy for CINV, where children inhaled peppermint essential oil from a piece of cotton before each chemotherapy session. Renani et al. (2023) applied orange essential oil to gauze and placed it under the child's pillow. Triana et al. (2022) used participant-selected essential oils by placing drops on clean gauze 20 cm away from the patient's chest to manage chronic pain. Weaver et al. (2020) used various aromatherapy sachets tailored for specific symptoms via aromatherapy sachets. Lastly, Evans et al. (2018) explored ginger aromatherapy for CINV, instructing children to take deep breaths of the ginger essence from a cup.

Level of Methodological Quality

Four quasi-experimental studies were assessed using the JBI checklist, and all were found to have a low risk of bias. Similarly, four randomized controlled trials were reviewed based on the JBI checklist, and they also demonstrated a low risk. However, the randomized controlled trials did not specify whether the outcome assessors were blinded to the treatment assignments. Additionally, two studies did not report whether the allocation of participants to treatment groups was concealed. Furthermore, two studies failed to clarify if follow-ups were incomplete, and any differences between groups were neither identified nor analyzed (Figure 3). Figures 2 and 3 present the quality assessments for the quasi-experimental studies and RCTs, respectively.

Figure 2. Quality appraisal for quasi-experimental studies

	1	2	3	4	5	6	7	8	9	%	ROB
Badr et al., 2024a	1	1	1	1	1	1	1	1	1	99.99	L
Renani et al., 2023	1	1	1	1	1	NA	1	1	1	88.88	L
Triana et al., 2022	1	1	1	1	1	1	1	1	1	99.99	L
Weaver et al., 2019	1	1	1	1	1	1	1	1	1	99.99	L

M: moderate, L: Low, 1= the article fulfills the checklist criteria; 0= the article does not fulfill the checklist criteria, NA: Not Applicable

Figure 3. Quality appraisal for randomized controlled trials

	1	2	3	4	5	6	7	8	9	10	11	12	13	%	ROB
Badr et al., 2024b	1	NA	1	NA	NA	NA	1	1	1	1	1	1	1	69.23	M
Şancı et al., 2023	1	NA	1	1	0	NA	1	1	1	1	1	1	1	76.92	L
Evans et al., 2018	1	1	1	1	1	NA	1	0	1	1	1	1	1	84.62	L
Ndao et al., 2012	1	1	1	1	1	NA	1	0	1	1	1	1	1	84.62	L

M: moderate, L: Low, 1= the article fulfills the checklist criteria; 0= the article does not fulfill the checklist criteria, NA: Not Applicable

DISCUSSION

Aromatherapy has gained importance as a CAM in the management of cancer-related symptoms. Its popularity stems from its noninvasive nature, ease of application, and minimal side effects compared to traditional pharmacological treatments. This systematic review aimed to identify, evaluate, and summarize the evidence regarding the effectiveness of aromatherapy in symptom management for pediatric oncology patients. Our review focuses on treating typical pediatric

oncology symptoms such as nausea and vomiting, pain, psychosocial side effects, and quality of life. Five studies concentrated on CINV, while three studies targeted other symptoms such as sleep disturbances, mood, anxiety, and pain. Similar to our study findings, aromatherapy studies with adults also show that these essential oils manage many different symptoms (Baykal & Çömlekçi, 2020; Corasaniti et al., 2023; Li et al., 2022; Monteiro-Oliveira et al., 2021). These findings highlight the diverse applications and potential benefits of aromatherapy in alleviating various

symptoms experienced by pediatric oncology patients.

CINV is among the most common side effects of cancer treatments, and pediatric patients frequently experience these symptoms (Patel et al., 2017). Our review demonstrated that aromatherapy significantly reduced the frequency and severity of CINV in children with cancer. This therapeutic approach proved particularly effective in alleviating CINV, offering a non-invasive and well-tolerated complementary option that improved patient comfort and minimized reliance on traditional antiemetic medications. The findings highlight the potential of aromatherapy as a valuable adjunct to standard care in managing these distressing symptoms. Several RCTs investigating the effect of aromatherapy on CINV in children with childhood cancer yielded encouraging results (Badr et al., 2024a; Şancı et al., 2023). Furthermore, in a quasi-experimental study by Badr et al. (2024b), significant antiemetic effects of peppermint aromatherapy inhalation, including the alleviation of CINV, were observed. In cancer patients, vomiting is often triggered by the release of certain chemicals in the body, which are typically targeted by medications to prevent nausea. Aromatherapy works by stimulating brain cells through the sense of smell, acting as a natural way to block these triggers. This process affects both the brain and the digestive system, helping to reduce feelings of nausea (Baykal & Çömlekçi, 2020; Gupta et al., 2021). These findings indicate that aromatherapy could be a practical complementary approach for managing chemotherapy-induced nausea and vomiting (CINV) in pediatric oncology patients. Additionally, peppermint is recognized as one of the most effective and commonly used essential oils for alleviating nausea and vomiting (Ahn et al., 2024). This aligns with our review, where studies reporting significant effects of aromatherapy on CINV predominantly used essential oils containing peppermint (Badr et al., 2024b; Şancı et al., 2023). For instance, Badr et al. (2024b) found that peppermint aromatherapy significantly alleviated CINV in pediatric patients. Similarly, Şancı et al. (2023) demonstrated that combining peppermint and lemon reduced nausea and vomiting in chemotherapy children. These findings support our conclusion that peppermint, whether used alone or combined with other essential oils like lemon, shows promising results in managing CINV. When the Joanna Briggs Institute Evidence-Based Database is reviewed, no

definitive level of evidence is found regarding aromatherapies. However, it is stated that ginger can be considered as a complementary treatment alongside standard antiemetic drugs to manage acute chemotherapy-induced vomiting (Grade B). (Choi et al., 2022). Considering the lack of definitive evidence for aromatherapies, but the recognized potential of ginger as a complementary treatment, incorporating ginger alongside standard antiemetic drugs may be a beneficial approach in managing acute chemotherapy-induced vomiting.

Our review of several studies investigating the effectiveness of aromatherapy in symptom management in pediatric oncology patients provides insights into pain. However, the studies included in our review did not specify which aromatherapy essential oils were used for pain management. Triana et al. (2022) addressed chronic pain management through participant-selected essential oils, allowing patients to choose their preferred scents. This personalized approach may enhance the effectiveness of aromatherapy by aligning with individual preferences and psychological comfort. Weaver et al. (2020) investigated various aromatherapy sachets, which included a range of essential oils such as ginger, cardamom, spearmint, and fennel, tailored for different symptoms. While these studies did not pinpoint specific oils for pain management, the broader literature suggests that certain compounds, such as linalool found in lavender oil, are particularly effective (Abbaszadeh et al., 2017; Dimitriou et al., 2017). Linalool inhibits GABA (gamma-aminobutyric acid) and reduces pain by affecting the glutamate bonds of neurotransmitters, highlighting its potential utility in aromatherapy interventions (Abbaszadeh et al., 2017; Baykal & Çömlekçi, 2020). This mechanism indicates that the targeted use of specific essential oils, like lavender, could optimize patient pain management outcomes. Lastly, while applying aromatherapy through massage is generally preferred for pain management due to its dual benefits of touch and scent, the studies included in our review utilized inhalation methods (Triana et al., 2022; Weaver et al., 2020). This method is practical and non-invasive, making it suitable for pediatric patients. However, these studies did not explore the therapeutic benefits of massage, which combines the physical relaxation of muscle tissues with the psychological comfort of touch. As used in the included studies, the diffusion method offers an alternative that is easier to administer and control

in a clinical setting. However, it may not be as effective in pain relief as aromatherapy applied through massage. Future research should investigate the comparative effectiveness of various aromatherapy essential oils, integrate massage techniques, and identify the most effective essential oils for pain management in pediatric oncology patients.

Many of the included articles focused on evaluating the effectiveness of aromatherapy on various symptoms such as mood, anxiety, QoL, and sleep disturbances in pediatric oncology patients. However, these are still preliminary studies for pediatric oncology patients, and the lack of comprehensive research in this area makes it difficult to draw definitive conclusions. When the studies conducted with the general pediatrics group were examined, Barkhordari et al.'s (2020) systematic review reports that aromatherapy interventions facilitate sleep and calmness and reduce anxiety in children with burns. Kharghani et al.'s (2020) study examined aromatherapy interventions in children with dental anxiety, and the results report the anxiety-reducing effect of the orange scent in children. In the study by Keyhanmehr et al. (2018), aromatherapy with *Rosa damascena* was safe and effective in improving sleep quality in children with sleep disorders. Although aromatherapy has been studied more extensively in adults, it is promising that such studies are being initiated in pediatrics. Another similar study by Sanchez et al. (2022) examined the effects of inhalation aromatherapy as a complementary treatment in clinical practice in pediatric patients. It emphasized that the findings are still inconclusive. They emphasized that future studies with high methodological quality, blinding, and adequate sample sizes must provide more definitive evidence. The current findings, while encouraging, are insufficient to make definitive claims about the effectiveness of aromatherapy in managing these symptoms in pediatric oncology patients. Further research is needed to confirm these preliminary findings and establish clear evidence-based guidelines for using aromatherapy in this population.

Limitations

This study has some limitations that could affect the overall validity of the results. The lack of blind outcome assessors in all RCTs may represent a limitation, as it may introduce detection bias and potentially influence the outcomes. Additionally, the failure to report on allocation concealment in

two studies and the absence of follow-up completion data in the other two studies highlight gaps in the reporting standards. These omissions not only affect the internal validity of the studies but also limit the generalizability of the findings. Therefore, while the overall quality of the included studies is commendable, addressing these limitations in future research is essential to enhance the methodological rigor and applicability of the results.

CONCLUSION

Our systematic review highlights the potential of aromatherapy as a complementary approach for managing a variety of symptoms in pediatric oncology patients, including CINV, pain, sleep disturbances, and mood and anxiety disorders. While the findings are promising, the variability in study quality and methodologies underscores the need for more rigorous research. Future studies should utilize high methodological standards, including blinding and adequate sample sizes, to provide more definitive evidence. Additionally, further exploration into the specific essential oils and application methods, such as the integration of massage techniques, is essential to optimize aromatherapy interventions. Although aromatherapy has been extensively studied in adults, initiating these studies in pediatric oncology is encouraging and warrants further investigation. Establishing evidence-based guidelines for aromatherapy in pediatric oncology could significantly enhance supportive care and improve young patients undergoing cancer treatment QoL.

Author Contributions

Idea/Concept: E.H.S.; Design: E.H.S., R.S.; Supervision/Consulting: R.S.; Analysis and/or Interpretation: E.H.S., R.S.; Literature Search: E.H.S., R.S.; Writing the Article: E.H.S., R.S.; Critical Review: E.H.S., R.S.

Peer-review

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Conflict of Interest

The authors have no conflict of interest to declare.

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