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Non-Pharmacological Management of Nausea and Vomiting in Cancer: A Scoping Review

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Abstract

Prevention and management of nausea and vomiting are important in cancer treatment. Effective management requires both pharmacological and non-pharmacological interventions. Patients and family members have important contributions to achieve effective control of nausea and vomiting through self-management. The objective of this review is to explore and synthesize the scientific literature about self-management strategies as a type of non-pharmacological intervention for managing nausea and vomiting in cancer patients. The articles were searched in PubMed, Science Direct and ClinicalKey databases using keyword combinations of "cancer", “non-pharmacological”, "intervention", "management", "nausea" and "vomiting". The inclusion criteria were articles that were free; full text; published in the last five years; provided information about non-pharmacological strategies in managing nausea and vomiting in cancer; and were written in English. Out of a total of 232 papers identified, 21 were selected. The results show that non-pharmacological management of nausea and vomiting ranged from simple self-management techniques to integrative therapies and palliative interventions. Self-management emphasizes patient autonomy in their own care and encourages patients and families to assume the responsibility of managing relevant aspects of their condition. The strategies include dietary modifications, environmental modifications, psychological strategies, exercise and taking of medication as prescribed. The interventions discussed in this article can be applied by patients as directed or instructed by healthcare teams. Nurses play an important role in educating patients on non-pharmacological interventions and encouraging them to achieve self-efficacy. Further research of other such interventions with larger sample sizes is needed to provide more accurate results.

Keywords: cancer, intervention, nausea, non-pharmacological, management, vomiting

Abstrak

Manajemen Nonfarmakologis Mual dan Muntah pada Kanker: **Scoping Review.** *Pencegahan dan pengelolaan mual dan muntah penting dalam pengobatan kanker, yang efektif dengan intervensi farmakologis dan nonfarmakologis. Pasien dan anggota keluarga pun mempunyai kontribusi penting untuk mencapai pengendalian mual dan muntah yang efektif melalui manajemen diri pasien. Tujuan dari tinjauan ini adalah untuk mengeksplorasi dan menyintesis literatur ilmiah tentang strategi manajemen diri sebagai jenis intervensi nonfarmakologis untuk mengelola mual dan muntah pada pasien kanker. Artikel-artikel tersebut dicari di basis data* PubMed, Science Direct, *dan* ClinicalKey *menggunakan kombinasi kata kunci "kanker", "non-farmakologis", "intervensi", "manajemen", "mual", dan "muntah" dengan kriteria inklusi seperti: artikel tidak berbayar; teks lengkap; diterbitkan dalam lima tahun terakhir; memberikan informasi tentang strategi non farmakologis dalam manajemen mual muntah pada pasien kanker; dan ditulis dalam Bahasa Inggris. Dari total 232 makalah yang diidentifikasi, 21 dipilih untuk penelitian ini. Hasil telaah menunjukkan bahwa manajemen nonfarmakologis mual dan muntah meliputi teknik manajemen diri yang sederhana hingga terapi integratif dan intervensi paliatif. Manajemen diri menekankan otonomi pasien dalam perawatan mandiri dengan mendorong pasien dan keluarga untuk bertanggung jawab mengelola aspek yang relevan dari kondisi mereka. Strategi tersebut meliputi modifikasi pola makan, modifikasi lingkungan, strategi psikologis, olahraga, dan minum obat sesuai resep. Intervensi yang dibahas dalam artikel ini dapat diterapkan oleh pasien seperti yang diarahkan atau diinstruksikan oleh tim kesehatan. Perawat memainkan peran penting dalam mendidik pasien tentang intervensi nonfarmakologis dan mendorong mereka untuk mencapai efikasi diri. Penelitian lebih lanjut dari intervensi serupa lainnya dengan ukuran sampel yang lebih besar diperlukan untuk memberikan hasil yang lebih akurat.*

Kata Kunci: *intervensi, kanker, manajemen, mual, muntah, nonfarmakologis*

Introduction

Cancer is a generic term for diseases that can attack any parts of the body and are characterized by fast abnormal cell division, cell growth beyond the limit, invasion of neighbouring body parts, or spread to other organs. The choice of cancer therapy includes chemotherapy, radiotherapy, and/or surgery that aims to treat cancer and improve the quality of life by supporting patients' physical, psychosocial and spiritual welfare and providing palliative care at the stage of terminal cancer (World Health Organization, 2022). Across the cancer trajectory, from the stage of screening and early detection up to that of survival or death, various responses are shown by patients, their families, and healthcare providers. These are displayed as signs, symptoms or side effects and toxicities that can have positive or negative impacts on patients (Yarbro et al., 2014). Patients' understanding of symptom management can optimize the palliation effect, relieve symptoms, and improve the quality of life (Shoemaker et al., 2011).

Nausea and vomiting are often experienced by cancer patients due to the nature of the disease and its associated therapy. Approaches to manage nausea and vomiting in cancer patients should begin with complete assessment, including the frequency, duration and intensity of nausea/vomiting; related activities; and whether anorexia or cachexia is present (Navari, 2020). Prevention and control of nausea and vomiting is important during cancer therapy. Chemotherapy-induced nausea and vomiting (CINV) are two of the most common and distressing symptoms for cancer patients treated in this way, with a prevalence of 80% and which have a significant impact on their quality of life. Poorly controlled nausea and vomiting may cause metabolic disturbances, malnutrition and anorexia, electrolyte imbalances, deterioration of mental state and functional ability, oesophageal tears, fractures, wound dehiscence, interruption to disease-related treatment, and degeneration of self-care and functional ability (PDQ Suppor-tive and Palliative Care Editorial Board, 2021; Ferrell & Paice, 2019).

Most research on nausea and vomiting focuses on the oncological population. Although there has been progress in anti-emetic therapy over the past three decades, nausea and vomiting are still to be one of the most feared and distressing symptoms for patients. Their management requires a combination of pharmacological and non-pharmacological approaches. Non-pharmacological management ranges from simple self-management techniques to integrative therapies and palliative interventions. Self-management emphasizes patient autonomy in their own care and encourages patients and families to assume the responsibility of managing rele-vant aspects of their condition (Ferrell & Paice, 2019). The objective of this review is to explore and synthesize the scientific literature about self-management strategies as one type of non-pharmacological intervention for managing nausea and vomiting in cancer patients.

Methods

The articles were searched in the PubMed, Science Direct, and ClinicalKey database using the following keywords in combination: "cancer", "non-pharmacological", "intervention", "management", "nausea" and "vomiting". The inclusion criteria for journal articles in this scoping review were that they were free; full text; published in the last five years (2017–2022); provided information about self-management strategies in managing nausea and vomiting in cancer; and were written in English. We did not specify the type of cancer or the type of cancer therapy which can trigger nausea and vomiting in order to expand the search results.

From the search results, 232 articles were identified. These were selected based on title, abstract and keywords. After manual screening by three authors of this manuscript, we removed one duplicate article and 175 that did not meet the inclusion criteria. 56 articles were selected for full text review. Seven of these were ex-

cluded because they were research protocols, five because they related to pharmacological interventions, and 23 as they related to non-pharmacological interventions other than self-management strategies and not related to nausea and vomiting. Twenty-one articles were considered suitable for inclusion in the final dataset. The procedure used to select the included papers is shown in Figure 1.

Results

A total of 21 research articles were reviewed in the scoping review (see Table 1). The research studied came from 10 countries, namely the Netherlands, Canada, Iran, Switzerland, Japan, Turkey, China, United States, Singapore, and Brazil. Seventeen articles involved adult cancer patient participants with advanced cancer or cancer survivors (n = 6); patients undergoing chemotherapy (n = 10); patients during autologous hematopoietic stem cell transplantation (AHSCT) (n = 1); and before or after cancer surgery (n = 2). The other two articles involved children and adolescents undergoing chemotherapy.

Three articles discussed environmental modifications, such as the use of peppermint oil and peppermint extract, or music therapy with periorbital massage (Dadkhah et al., 2019; Ertürk & Taşcı, 2021; Jafarimanesh et al., 2020). Seven articles reviewed psychological strategies using behavioural interventions, self-care education programs, integrated educational programs, dignity therapy, perceptual stress reduction, structured education, and serious game (Bayati et al., 2019; Cao et al., 2020; Hunter et al., 2020; Ince & Usta, 2020; Karimi et al., 2017; Loerzel et al., 2020; Zaki-Nejad et al., 2020). Other strategies, such as using exercise to improve nausea and vomiting, were discussed in four articles (Anestin et al., 2017; Chang et al., 2020; Nakano et al., 2018; van Waart et al., 2015). The other four articles reported on interventions related to abdominal massage, nutritional intervention, the combination of multiple non-pharmacological interventional components, and mixed intervention of nutrition and physical exercise (Cheng & Tan, 2021; de Souza et al., 2021; Nasab et al., 2021; Uster et al., 2018).

Discussion

Although there are various pharmacological interventions, nausea and vomiting remain the most distressing symptoms. Understanding non-pharmacological approaches to symptom management and integrating them into daily care can minimize the physiological effects of uncontrolled symptoms and their potential negative effects on the quality of life. Non-pharmacological interventions can be grouped into several strategies, such as self-management strategies, biological therapy, non-biological therapy, and acupuncture and acupressure. Self-management emphasizes patient autonomy in their own care and encourages patients and families to assume the responsibility of managing their condition. Some of the strategies are dietary modifications, environmental modifications, psychological strategies, and other strategies such as exercise and taking medications as prescribed (Ferrell & Paice, 2019).

Nutrition counselling can be used as an option for self-management strategies in the management of nausea and vomiting. In a randomized controlled trial study, Uster et al. (2018) provided three individual nutritional counselling sessions combined with a 60 minutes exercise program twice a week. The intervention was superior to usual care in terms of the patients' rating of symptom scales, nausea and vomiting and protein intake. Nutrition counselling conducted by de Souza et al. (2021) with breast cancer patients undergoing neoadjuvant chemotherapy produced relatively positive results. Participants received nutritional advice including guidelines on healthy eating and nutritional information to reduce CINV, together with individual diet plans from dietitians based on each subject's age, current weight and height. The intervention group had better quality of life, nausea and vomiting management, and

better appetite than the control group. It can be concluded that nutritional intervention can reduce nausea and vomiting.

Mentha piperita is mostly used as a remedy for spasms, cramps, headaches, migraines, indigestion, nausea and flatulence. A trial conducted by Jafamarinesh et al. (2020) using 40 drops of peppermint extract mixed with 20 cc of tap water every 8 hours was shown to reduce the severity of nausea, vomiting and anorexia in breast cancer patients undergoing breast cancer chemotherapy 24 and 48 hours after treatment. The use of peppermint as a complementary method can improve symptoms of nausea, vomiting and anorexia, but further studies with larger sample sizes and longer follow-up periods are needed to confirm these findings (Jafarimanesh et al., 2020). Peppermint oil was also employed by Ertürk and Taşcı (2021) in a quasi-randomized study of chemotherapy patients in a Turkish general hospital. In their study, the oil was used as aromatherapy, given as one drop between the upper lip and nose (philtrum) three times a day for five days after chemotherapy as an adjunct to routine antiemetic therapy. Participants were asked to take deep breaths after using the aromatic mixture to receive a refreshing effect and pleasant aroma. The results of the study show that the visual analogue scale (VAS) score on nausea was lower in the intervention group and that there was a significant difference in changes

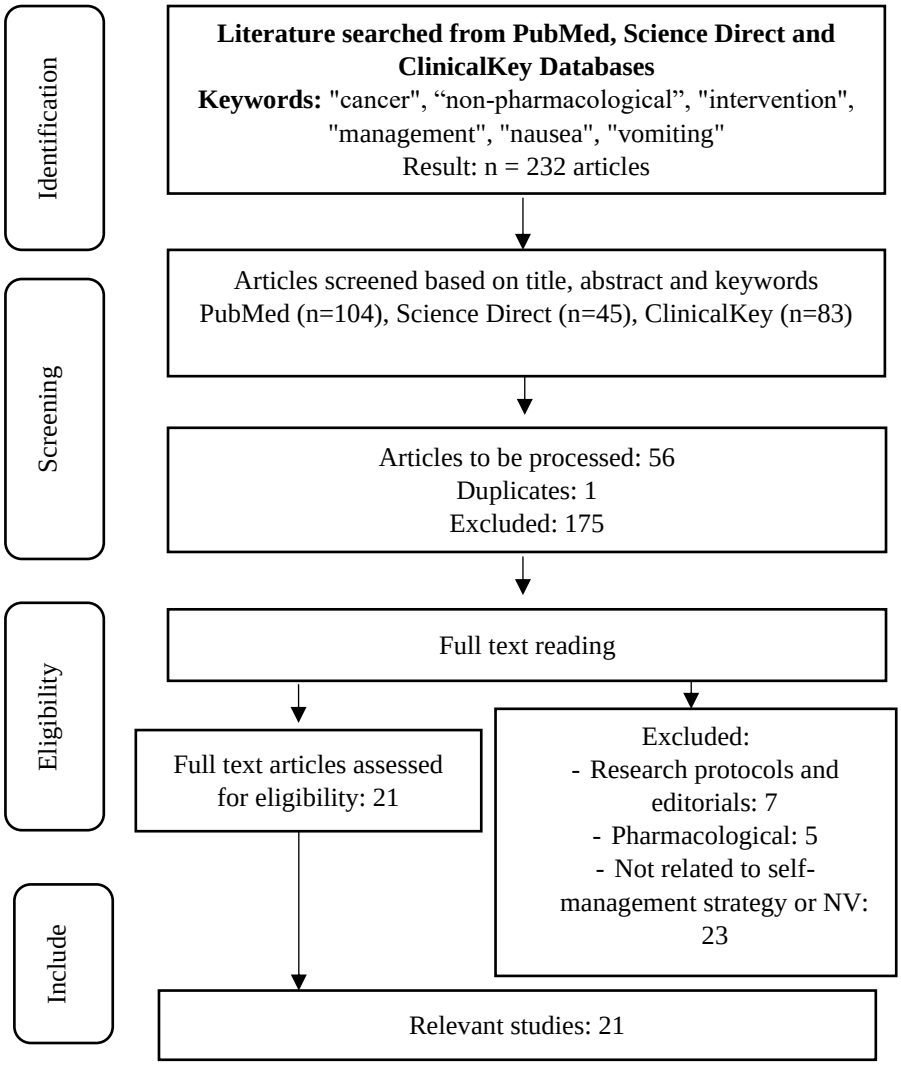

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyse

Table 1. Data Analysis

No.	Author, Year, Title	Methods	Intervention	Results
1	Van Waart et al. (2015) *Effect of low-intensity physical activity and moderate- to high-intensity physical exercise during adjuvant chemotherapy on physical fitness, fatigue, and chemotherapy completion rates: Results of the PACES randomized clinical trial*	RCT. Patients who were scheduled to undergo adjuvant chemotherapy (N = 230) were divided into Onco-Move (n = 77), OnTrack (n = 76), or UC (n = 77) groups. Performance-based and self-reported outcomes were assessed before random assignment at the end of chemotherapy, and at the 6-month follow-up. Onco-Move and OnTrack intervention started in the first cycle of chemotherapy and continued until 3 weeks after the last cycle.	Onco-Move is a home-based, low-intensity, individualized, self-managed physical activity program. Behavioral reinforcement techniques were added. Specially trained nurses motivated participants to engage in at least 30 minutes of physical activity per day, 5 days per week, with an intensity level of 12 to 14 on the Borg Scale of perceived exertion. OnTrack is a moderate- to high-intensity, combined resistance and aerobic exercise program, which was super-vised by specially-trained physical therapists. Participants attended two sessions per week. Six large muscle groups were trained for 20 minutes per session, with two series of eight repetitions at 80% of the one repetition maximum. UC varied according to hospital guidelines and preferences, but did not involve routine exercise.	Onco-Move and OnTrack resulted in less reduction in cardiorespiratory fitness ($p < 0.001$), better physical function ($p < .001$), less nausea and vomiting ($p < .029$ & .031) and less pain ($p < .003$ & .011) compared to UC. OnTrack also resulted in greater muscle strength ($p < .002$) and less physical fatigue ($p < .001$). At the 6-month follow-up, most of the outcomes had returned to baseline for all the groups.
2	Anestin et al. (2017) *The Effects of the Bali Yoga Program for Breast Cancer Patients on Chemotherapy-Induced Nausea and Vomiting: Results of a Partially Randomized and Blinded Controlled Trial*	A partially randomized and blind controlled trial. A total of 82 adult patients with stage I to III breast cancer who were receiving chemotherapy were assigned to the intervention group (n = 52) or the control group (n = 30).	The intervention group received an 8-week Balinese yoga program alongside standard care. The control group only received standard care for 8 weeks, followed by a Balinese yoga program for an additional 8 weeks. The yoga program consisted of 8 weekly group sessions of 90 minutes, with five participants per group, led by one instructor. Participants were also given DVDs in 20 40 minutes formats.	No significant difference between the experimental and control groups in terms of CINV was shown after 8 weeks. The results showed no benefit of the yoga program in managing NV. However, considering the preliminary evidence showing the beneficial impact of yoga in the management of cancer symptoms, methodological limitations should be explored and additional studies should be undertaken.
3	Karimi et al. (2017) *Surveying the effect of a self-care education program on severity of nausea and emesis in*	This semi-experimental research was conducted at Imam Reza Kermanshah Hospital, Iran. A total of 52 colorectal cancer patients who were undergoing chemotherapy were divided into control and intervention groups (n = @26). Data were collected using a	The intervention group received a self-care exercise package, including progressive muscle relaxation, music therapy and nutrition education over 12 sessions, including the use of educational tools such as pamphlets, brochures, pictures, and videos. The sessions were	There was a significant reduction in the intensity and frequency of nausea and vomiting after the intervention. The p-value of the Mann–Whitney U test for the intensity of nausea in the experimental and control groups af-

Table 1. Data Analysis

No.	Author, Year, Title	Methods	Intervention	Results
	colorectal cancer patients under chemotherapy	demographic questionnaire. Morrow Assessment of Nausea and Emesis.	conducted for two months with a duration of 45 – 60 minutes each.	ter the intervention indicated that the self-care program was effective.
4	Uster et al. (2018) *Effects of nutrition and physical exercise intervention in palliative cancer patients: A randomized controlled trial*	RCT. Patients were randomized into intervention (n = 20) and control (n = 20) groups. The intervention was conducted for 3 months. Using the EORTC Quality of Life Questionnaire version 3.0, physical performance, nutritional status, dietary intake, and clinical data were measured at baseline and after 3 and 6 months.	The intervention group received at least three individualized standardized nutrition counselling sessions and participated in a 60-minute exercise program twice a week. The control group received the usual care.	No difference in global health status/general quality of life was shown. The intervention was superior to usual care in terms of the symptom scale assessed by the patient, nausea and vomiting ($p = 0.023$) and protein intake ($p = 0.01$). No significant difference shown in energy intake, nutrition or physical performance.
5	Nakano et al. (2018) *Effects of Aerobic and Resistance Exercises on Physical Symptoms in Cancer Patients: A Meta-analysis*	Systematic review and meta-analysis. Ten studies exploring the effects of exercise on physical symptoms, including fatigue, nausea/vomiting, pain, dyspnea, insomnia, loss of appetite, constipation, and diarrhea in cancer patients and survivors were conducted qualitatively (meta-analysis). Cancer-related physical symptoms were measured by the EORTC QLQ-C30.	Resistance, aerobic, or mixed training.	The mean PEDro score was 5.43 (SD = 1.28). Fatigue, pain, dyspnea, and insomnia were significantly lower in the intervention group post-intervention in the cancer patients. The exercise intervention did not improve or suppress nausea/vomiting, loss of appetite, constipation or diarrhea in the patients.
6	Dadkhah et al. (2019) *Effect of Music Therapy with Periorbital Massage on Chemotherapy-Induced Nausea and Vomiting In Gastrointestinal Cancer: A Randomized Controlled Trail*	RCT. 60 gastrointestinal cancer patients with chemotherapy were randomized into intervention and control groups. The Rhodes questionnaire was used to assess nausea and vomiting before and 24 hours after chemotherapy.	The intervention group received two concurrent interventions in the form of music therapy and periorbital massage, while the control group received routine intervention. The music therapy involved calming music including classical (e.g. Beethoven) and traditional music that contained slow, consistent and melodic rhythms. Music was played for 45 minutes during chemotherapy via an MP3 player and headphones. An electronic eye massager was placed over the patients' eyeballs for 15 minutes during treatment.	Music therapy plus periorbital massage significantly reduced nausea ($p = .000$) and vomiting ($p = .004$) in patients in the intervention group undergoing chemotherapy compared to the control group.
7	Bayati et al. (2019) *Investigating the effect of integrated educational program on the*	Clinical trial study. 64 patients were admitted to a special cancer hospital affiliated with Ahvaz Jundishapur University of Medical Sciences, Iran, and selected according to inclusion criteria. Through the block	The intervention group received integrated training for four sessions of 60 minute duration (one session/week). The educational content was approved by dietitians, cancer specialists, cancer nurses and	All functional and symptomatic (fatigue, nausea vomiting, pain, shortness of breath, sleep disturbances, loss of appetite, constipation and diarrhea) dimensions of quality of

Table 1. Data Analysis

No.	Author, Year, Title	Methods	Intervention	Results
	quality of life among cancer patients: A clinical trial study	randomization method, they were divided into intervention and control groups (@ 32 patients). The data collected included demographic and quality of life (QLQ-C30) data. Quality of life was measured before and 2 months after training.	psychologists and covered spiritual and emotional care, diet and symptom management.	life in the intervention group significantly improved one and two months after following the integrated education program.
8	Hunter et al. (2020) *A randomized trial of nurse-administered behavioral interventions to manage anticipatory nausea and vomiting in chemotherapy*	Randomized, three-arm trial. Patients undergoing chemotherapy for solid tumors were randomized into mindfulness relaxation_(MR) (N = 160), relaxation music_(RM) (N = 159) and standard care_(SC) groups (N = 155). Anticipatory nausea and vomiting were assessed at the mid and end points of the chemotherapy series using the Morrow Assessment of Nausea and Emesis (MANE).	The MR group received guided mindfulness/awareness exercises, imagery, and relaxation practices for around 20 minutes, repeated during chemotherapy. The RM group received recordings identical to those of MR, but without specific relaxation/meditation instructtions; just relaxing music with sounds of nature or vocal tracks. In the SC group, patients received general information about the management of chemotherapy-related symptoms. The MR and RM groups also received this information.	Compared with the SC group, there was a decrease in mid-chemo anti-cipatory nausea in the MR (OR 0.44, 95% CI 0.20 – 0.93) and RM (OR 0.40, 95% CI 0.20 – 0.93) groups, after controlling for age, sex, cancer stage, and emetogenic level of chemotherapy. There was no difference between the treatment groups in anticipatory nausea and vomiting at the end of chemotherapy and the post-chemotherapy sessions.
9	Zaki-Nejad et al. (2020) *The effect of dignity therapy on the quality of life of patients with cancer receiving palliative care*	Quasi-experimental study. 50 patients with cancer admitted to a palliative care center in Tehran, Iran, during the period 2017 – 2018 who met the inclusion criteria were selected through convenience sampling (intervention and control group @ 25 patients). The EORTC-QLQ-C15-Pal instrument was used and completed by the patients before and 2 weeks after dignity therapy.	Dignity therapy was divided into three sessions. Session I was an introduction to the approach method (known as the 13-question protocol of dignity therapy); in session II (24-48 hours later), the researchers guided participants to talk about important aspects of their lives and whatever they wanted to record as memory based on certain questions in the protocol; while in session III (3 days later), the text prepared was read to the participants and corrected if necessary. The final version of the text was given to participants to share with their loved ones.	Dignity therapy improved the quality of life in the intervention group ($t35.18 = 4.82$, $p = 0.001$). There were significant differences between the two groups in terms of physical functional scale ($t32.96 = 2.60$, $p = 0.01$) and emotional functioning ($t45.69 = 6.54$, $p < 0.001$). Dignity therapy also improved nausea and vomiting ($\chi2 = 5.71$, $p = 0.02$), insomnia ($\chi2 = 15.78$, $p < 0.001$), appetite ($\chi2 = 5.09$, $p = 0.02$), and constipation ($\chi2 = 12.50$, $p < 0.001$).
10	Jafarimanesh et al. (2020) *The Effect of Peppermint (Mentha piperita) Extract on the Severity of*	RCT. The sample comprised 84 breast cancer patients undergoing chemotherapy who were divided into experimental and control groups (n = 42). The severity of nausea, vomiting, and anorexia was measur-	Patients in the experimental group received 40 drops of peppermint extract mixed with 20 cc of tap water every 8 hours, while patients in the control group received 40 drops of distilled water mixed	There was a significant difference between the two groups at 24 and 48 hours after chemotherapy ($p < .05$). The mean score for the severity of nausea, vomiting and anorexia in

Table 1. Data Analysis

No.	Author, Year, Title	Methods	Intervention	Results
	Nausea, Vomiting and Anorexia in Patients with Breast Cancer Undergoing Chemotherapy: A Randomized Controlled Trial	ed and recorded before, immediately after intervention, and 24 and 48 hours after chemotherapy using the Visual Analog Scale (VAS).	with 20 cc of tap water every 8 hours.	the experimental group was lower than for the control group ($p < .05$).
11	Cao et al. (2020) *Effect of perceptual stress reduction control intervention on the level of symptoms in breast cancer at different time points*	A total of 124 patients who met the inclusion criteria and were undergoing breast cancer surgery at Harbin Medical University Cancer Hospital, China from March 2018 – February 2019 participated in this study. 62 patients were included in the intervention and control groups. Symptom cluster rates at different times were compared between the two groups.	Both groups were given preoperative care and routine chemotherapy. The intervention group was given a perceptual stress reduction control intervention through diluion therapy and meditation before going to bed.	Perceptual stress reduction control interventions were shown to effectively relieve bone marrow suppression, digestive tract discomfort (nausea, vomiting, diarrhea), and breast discomfort symptoms, as well as to improve health promotion behaviors.
12	Ince and Usta (2020) *The Effect on Nausea and Vomiting of Structured Education Given to Male Lung Cancer Patients Receiving Chemotherapy*	A quasi-experimental study with pre-posttest control groups. 40 lung cancer survivors who met the inclusion criteria were followed in the chest disease clinic and outpatient chemotherapy unit at a university hospital in Turkey and were grouped into experimental and control groups (@n = 20). Nausea and vomiting were measured using VAS before chemotherapy (pre-test), 24 hours after chemotherapy (post-test 1), and 4 – 6 days after chemotherapy (post-test 2).	A 30-minute educational program was given before chemotherapy. Participants were given a 16-page booklet after the training. The booklet and educational sessions covered the following topics: (1) definition (nausea, vomiting), (2) etiology, (3) pathophysiology, (4) types of nausea and vomiting, (5) therapeutic strategies, (6) non-pharmaco-logical methods, (7) nutrition, and (8) prevention strategies.	In post-test 1, the severity of nausea was significantly lower in the experimental group than in the control group. The same occurred in post-test 2. The frequency of vomiting did not differ significantly between the experimental and control groups in either post-test 1 or post-test 2 ($p>0.05$).
13	Loerzel et al. (2020) *Using Serious Games to Increase Prevention and Self-Management of Chemotherapy-Induced Nausea and Vomiting in Older Adults With Cancer*	80 elderly patients (aged 60 years or older) and newly diagnosed with cancer were recruited from the community cancer centre. Participants were randomized into intervention (n = 38) and control (n = 42) groups. A symptom management checklist was used to record preventive and self-management behavior and was used after home chemotherapy. Acceptability and usability were assessed using a short survey.	The intervention was divided into two parts: 1) playing a serious game on an iPad in the therapy room before receiving the first chemotherapy; and 2) discussing the outcome with the research nurse. Participants played through a 3-day simulation scenario with various opportunities to make decisions for their avatars.	The intervention group displayed more preventive behaviors, while the control group used more self-management behaviors. Antiemetics were the most commonly used strategy, followed by dietary strategies. Participants rated all aspects of the game seriously in terms of usability and acceptability.

Table 1. Data Analysis

No.	Author, Year, Title	Methods	Intervention	Results
14	Chang et al. (2020) *The effectiveness of a nurse-led exercise and health education informatics program on exercise capacity and quality of life*	RCT. Patients who had undergone esophagectomy for cancer were recruited through purposive sampling from a medical center in Taiwan. Patients who met the inclusion criteria and agreed to participate (N = 88) were randomly assigned to either an informatics training program (intervention group, n = 44) or usual postoperative care (control group, n = 44). Quality of life was measured at baseline, and 1, 3 and 6 months after the patient was discharged. Secondary nutritional outcomes (albumin, BMI) and exercise capacity were measured at baseline and 3 months after discharge. Differences in quality of life, nutrition, and exercise capacity between the two groups were analyzed using generalized equivalence estimates.	The intervention group received a health education informatics program and training for 12 weeks in addition to usual care. The program consists of three parts: a home walking exercise program, a nursing education program, and instructions for using the information system. The walking program included moderate-intensity walks after meals, 3 – 5 days per week for 30 minutes each; a total of 150 minutes per week. Exercise data were obtained from the number of walks, blood pressure and pulse monitored by the smart bracelet.	Functional scores of physical health (1 & 3 months), role (1, 3, & 6 months), emotional (1 month), social (3 months) and global health (3 months) were significantly higher in the intervention group. Cancer-associated subscales improved for insomnia (1 & 3 months) and nausea and vomiting (3 & 6 months). Specific symptoms of esophageal cancer improved in relation to dry mouth (1 month), dysphagia (3 months), and loss of taste (1 & 6 months). 3 months after discharge, albumin levels were significantly higher for the intervention group.
15	Izgu et al. (2020) *Inhalation aromatherapy on nausea, vomiting and anxiety during autologous hematopoietic stem cell transplantation: An open-label randomized controlled trial*	Open-label randomized controlled trial. The study was conducted at two stem cell transplantation units in Ankara, Turkey. A total of 70 patients were randomly assigned to either an intervention (n = 35) or a control group (n = 35).	Patients in the intervention group inhaled the odor from six drops of pure orange essential oil during AHSCT. Those in the control group received routine care. Nausea severity was evaluated at baseline and the beginning of each new infusion bag. The level of vomiting and retching episodes was recorded during the AHSCT. Anxiety levels were measured just after the completion of the AHSCT.	Inhalation aromatherapy with orange essential oil may be useful to alleviate anxiety during AHSCT; however, it does not appear to decrease the severity of nausea, nor the number of vomiting and retching episodes.
16	Rafiee Sarbijan Nasab et al. (2021) *Effect of Abdominal Massage with and without Salvia officinalis on Nausea and Vomiting in Patients with Cancer Undergoing Chemotherapy: A*	RCT. 60 patients undergoing chemotherapy at Kerman University of Medical Sciences, Kerman, southeastern Iran were divided into intervention groups (A and B, @ 20 patients) and a control group (C, n = 20). Nausea and vomiting were measured by VAS.	Group A received abdominal massage without Salvia officinalis, performed for 15 minutes for three consecutive days, twice a day at 08.30 and 20.30, on an empty stomach. Massage started from the beginning of the ascending colon, clockwise, towards the horizontal colon and finished at the end of the descending colon. Swedish massage included strokes, effleurage, vibration and kneading. Group B	Immediately after the intervention, the mean nausea score in group B was lower than in the control group. The mean score of nausea in group A and the control was no different. One week after the intervention, the mean nausea score did not differ between the three groups. The frequency of vomiting also did not differ.

Table 1. Data Analysis

No.	Author, Year, Title	Methods	Intervention	Results
	Randomized Clinical Trial		received massage with 2 mL of 100% aromatic Salvia officinalis substance. Group C received routine care.	
17	Cheng and Tan (2021) *A pilot study of the effect of a home-based multimodal symptom-management program in children and adolescents undergoing chemotherapy*	An exploratory randomized pilot study with qualitative interviews. 50 patients aged between 10 and 18 were randomized into either the symptom management program plus usual care (intervention, n = 25) or usual care (control, n = 25) group. Target symptoms were measured at baseline (after diagnosis), the first 2 weeks of each chemotherapy cycle, and 6 months after baseline, using the Memorial Symptom Assessment Scale and the State Anxiety Scale for Children.	Psychoeducational program intervention providing information to children, adolescents, and their families about the knowledge, skills, and support needed for symptom prevention and management. The content consisted of non-pharmacological interventions (progressive muscle relaxation, distraction strategies, guided imagery, energy conservation, food preparation advice, oral care, and warm cold compresses).	The intervention group experienced lower fatigue ($p < .05$). However, there were no differences in nausea, vomiting, pain, mucositis, and anxiety between the groups. Both the children and the parents reported positive experiences with the symptom management program.
18	Efe Ertürk and Taşcı (2021) *The Effects of Peppermint Oil on Nausea, Vomiting and Retching in Cancer Patients Undergoing Chemotherapy: An Open Label Quasi–Randomized Controlled Pilot Study*	Quasi-randomized controlled study. 80 patients were recruited from the outpatient chemotherapy unit of a general hospital in Batman, Turkey, between September 2017 and September 2018. 36 patients were placed in the intervention group, and 44 into the control group. Data were collected using patient information forms; VAS, to measure the severity of nausea; patient watch charts; the Index of Nausea, Vomiting, and Retching, Aromatherapy Practice Guide; and patient opinion forms regarding aromatherapy practices.	Participants in the intervention group administered 1 drop of the aromatic mixture between the upper lip and nose (philtrum), 3 times daily for 5 days after chemotherapy, in addition to routine antiemetic therapy. They were asked to take a deep breath after using the aromatic mixture. The control group only received routine antiemetic therapy.	VAS scores for nausea were lower in the intervention group and there was a significant difference in the frequency of nausea and vomiting in all chemotherapy regimens, except for cisplatin ($p < 0.05$).
19	de Souza et al. (2021) *Nutritional intervention contributes to the improvement of symptoms related to quality of life in breast cancer patients undergoing neoadjuvant chemotherapy: A*	RCT. 34 women with breast cancer undergoing neoadjuvant chemotherapy were divided into an intervention group (IG, n = 19) and a control group (CG, n = 15). Measurements were taken at the beginning before the start of the first cycle of chemotherapy (T0), during the second and third cycles (T1, T2), and at the end of the third cycle (T3).	All participants received nutritional advice on healthy eating and nutritional information for reducing CINV. Only the IG received individual personalized diet plans from dietitians based on age, current weight, and height.	CG significantly decreased hand grip strength (HGS), while IG showed no change in this variable. For QoL, GI plays a better role in function and nausea, vomiting and appetite than CG. For haematological and gastrointestinal toxicity, GI had less leukopenia and abdominal pain.

Table 1. Data Analysis

No.	Author, Year, Title	Methods	Intervention	Results
	randomized clinical trial			
20	Mao et al.(2021) *Effect of Electrical Stimulation on Gastrointestinal Symptoms in Lung Cancer Patients during Chemotherapy: A Randomized Controlled Trial*	RCT. A total of 122 lung cancer patients receiving chemotherapy were assigned randomly to a control group (usual care group, n = 61) and intervention group (TAES plus GES, n = 61). *TAES: transcutaneous acupoint electric stimulation; GES: gastric electrical stimulation	TAES involved two acupoints, Neiguan (PC6) and Zusanli (ST36). GES was performed at gastric pacing sites on the body surface, such as the locations of projection of gastric antrum and corpus on the body surface. GES was performed on these sites for 14 days continuously (25 min each time, once daily). The effects of TAES and GES on GI symptoms were assessed using the Memorial Symptom Assessment Scale on the day prior to chemotherapy (time point 1) and on days 14 (time point 2) and 28 (time point 3) after chemotherapy	Differences in symptom occurrence and severity at time point 1 were not statistically significant between the two groups. At time points 2 and 3, GI symptoms such as loss of appetite, nausea, vomiting, diarrhea, and constipation in the stimulation group had statistically significantly improved compared with the control group. TAES and GES were efficacious in relieving GI discomfort in lung cancer patients after chemotherapy.
21	Semerci et al. (2022) *The effect of using an interactive mobile application for the management of chemotherapy-induced nausea and vomiting in children: Randomized controlled study*	A prospective, parallel-group and randomized controlled study. It was conducted in a university hospital between October 2019 and January 2021 with 57 children aged 8–18 years who were being treated with chemotherapy, together with their mothers.	In this study, a mobile application called "5inD" was developed, which included five distraction methods to reduce CINV. Data were collected about CINV through the Adapted Rhodes Index for Nausea & Vomiting child version (ARINVc), and parent version (ARINVp). The CINV of the children was evaluated for seven days, starting from the first day of chemotherapy.	The interactive mobile application was found effective in reducing CINV in the children. Additionally, it can be said that 5inD is more effective for the management of acute CINV than delayed CINV.

in the frequency of nausea and vomiting in all the chemotherapy regimens, apart from cisplatin (Ertürk & Taşcı, 2021). Another type of aromatherapy that can be used is orange essential oil. Izgu et al. (2020) used this to control nausea, vomiting and anxiety during autologous hematopoietic stem cell transplantation (AHSCT) by masking the malodor of dimethyl sulfoxide. As in the case of peppermint oil, inhalation aromatherapy with orange essential oil is effective in alleviating anxiety during AHSCT. The results of these studies can be used as a recommendation for the management of post-chemotherapy nausea and vomiting with low emetogenic agents as a safe additional antiemetic therapy.

Another self-management strategy is environmental modification (Ferrell & Paice, 2019). Dadkhah et al. (2019) conducted a RCT on gastrointestinal cancer patients given chemotherapy. Their study modified the environment by providing soothing sounds combined with relaxation interventions. The patients received two concurrent interventions (music therapy and periorbital massage). The music therapy involved soothing music including classical (e.g., Beet-

hoven) and traditional types, played for 45 minutes during chemotherapy via an MP3 player and headphones. An electronic eye massager was placed over the patient's eyeball for 15 minutes during chemotherapy. Such music therapy combined with periorbital massage significantly reduced nausea and vomiting in patients in the intervention group undergoing chemotherapy compared to those in control group.

Psychological strategies can be employed by using relaxation and meditation, practicing deep breathing, or using cognitive distraction (Ferrell & Paice, 2019). A study of a 3-arm RCT involving solid tumour patients undergoing chemotherapy in Texas employed behavioural intervention techniques such as mindfulness relaxation (MR) and relaxation music (RM) (Hunter et al., 2020). Participants in the MR group received guided mindfulness/awareness exercises, imagery, and relaxation practices for around 20 minutes, which were repeated during chemotherapy. The RM group heard recordings in an identical way to that of MR group, but without specific relaxation/meditation instructions, just relaxing music with sounds of nature or vocal tracks. As a control, a standard care group (SC) only received information about post-chemotherapy symptom management. Compared to the SC group, there was lower anticipatory nausea during chemotherapy in the MR and RM groups.

Semi-experimental research conducted by Karimi et al. (2017) also used a psychological approach in the form of a self-education program. Colorectal cancer patients undergoing chemotherapy received a self-care exercise package about what to do before and after chemotherapy, including progressive muscle relaxation, music therapy and nutrition education. The education was conducted over 12 sessions and educational tools included pamphlets, brochures, pictures, and videos. The sessions took place for two months and lasted 45 – 60 minutes. Positive results were obtained, with a significant reduction in the intensity and frequency of nausea and vomiting after the intervention. This indicates that the self-care program was effective and improved the patients' self-care ability to control nausea and vomiting. A positive outcome of the self-education approach in the intervention group was also reported by Bayati et al. (2019) in relation to all functional (physical, role function, emotional, cognitive, social) and symptomatic (fatigue, nausea and vomiting, pain, dyspnea, sleep disorders, diminished appetite, constipation, and diarrhea) dimensions of quality life. The intervention provided integrated training over four sessions of 60 minutes, with one session per week on spiritual care, emotional care, diet, and symptom management. Different results were obtained in a randomized exploratory pilot study with qualitative interviews conducted by Cheng and Tan (2021). Their study involved psychoeducational interventions in patients aged between 10 and 18 years. Information provided to the children, adolescents and their families concerned the knowledge, skills and support needed for symptom prevention and management. The content consisted of non-pharmacological interventions in the form of progressive muscle relaxation, distraction strategies, guided imagery, energy conservation, food preparation advice, oral care, and cold/warm compresses. Although both children and their parents reported positive experiences with the symptom management programs, there was no difference in the incidence of nausea and vomiting in the intervention and control groups.

A 30 minutes educational program was developed in semi-experimental research by Ince and Usta (2020) in Turkey, which was given to lung cancer patients before chemotherapy. Participants were given 16-page booklet containing the following topics: (1) definition (nausea, vomiting); (2) etiology; (3) pathophysiology; (4) types of nausea and vomiting; (5) therapeutic strategies; (6) non-pharmacological methods; (7) nutrition; and (8) prevention strategies. The severity of nausea was significantly lower in the experimental group than in the control group. However, the frequency of vomiting did not differ significantly between the experimental

and control groups. Structured education provided by nurses had a positive effect on the severity of nausea. Nurses were able to improve nausea management in cancer patients more effectively with educational interventions.

Dignity therapy implemented by Zaki-Nejad et al. (2020) was divided into three sessions. Session I was an introduction to the approach. The protocol consisted of 13 questions about important aspects of participants' life and anything they wanted to record as a memory. In session II (24 – 48 hours later), the researchers guided participants to talk about important aspects of their lives and whatever they wanted to record as memory based on certain questions in the protocol. The interview was recorded then transcribed and reviewed. At session III (three days later) the transcribed recording was read to the participants and corrected if necessary. The final version of the text was given to participants to share with their loved ones. Dignity therapy was found to improve quality of life in the intervention group and also to improve nausea, vomiting, and other symptoms in the palliative phase. Another intervention in the form of perceptual stress reduction control was analyzed in the study of Cao et al. (2020). Breast cancer patients undergoing surgical intervention and chemotherapy were given such intervention through dilution therapy and meditation before going to bed. After measuring the outcome, the intervention was shown to effectively relieve bone marrow suppression, digestive tract discomfort (nausea, vomiting, diarrhoea), and symptoms of breast discomfort, as well as improving health promotion behavior.

A unique intervention was performed by Loerzel et al. (2020) on elderly patients (60 years or older). It was divided into two parts: 1) playing a serious game on an iPad in the therapy room before receiving the first chemotherapy; and 2) discussing the outcome with the research nurse. The serious game focused on making prevention and self-management decisions for avatars, who, like the participants, were receiving their first chemotherapy and were going to manage any side effects independently at home. The participants played through a 3-day simulation scenario with various opportunities to make decisions for their avatars. Involving patients in self-care simulations can also be used as an effective approach. The distraction approach was used by Semerci et al. (2022) to manage CINV pediatric oncology patients. An interactive mobile application called 5inD was developed, which included five distraction methods to reduce CINV (music, puzzles, mandalas, blowing exercises, and Tetris). The study showed that the interactive mobile application was effective in reducing CINV in children.

Other self-management strategies include physical activity or exercise. An exercise program of low, moderate or high intensity, combined with resistance and aerobic exercise, can result in better physical functioning, improved cardiorespiratory fitness, less nausea and vomiting, less pain, better muscle output and less physical fatigue (van Waart et al., 2015). An exercise program combined with health education was employed by Chang et al. (2020). The program consisted of three parts: a home walking exercise program, a nursing education program, and instructions for using the information system. The walking program included moderately intensive walks after meals, 3 – 5 days per week, with each lasting 30 minutes, totalling 150 minutes per week. A positive outcome was indicated by a significant improvement in nutrition, exercise capacity, and variables related to quality of life and its subscales (insomnia, nausea, and vomiting).

Different results were obtained by Anestin et al. (2017) who conducted Balinese yoga intervention in breast cancer patients experiencing CINV. The program was run for 8 weeks alongside standard treatments and consisted of 8 weekly group sessions of 90 minutes duration, with five participants per group, led by one instructor. Participants were also given DVDs in 20- and 40-minute formats. However, there was no significant difference between the experimental and control groups with regard to

CINV after 8 weeks. These results indicate that such a yoga program is not beneficial in managing CINV. However, considering the preliminary evidence showing the beneficial impact of yoga in the management of cancer symptoms, methodological limitations should be explored, and additional studies should be conducted.

Integrative therapy such as abdominal massage was investigated by Nasab et al. (2021) in an RCT of patients undergoing chemotherapy. Patients in the intervention group received abdominal massage with or without Salvia officinalis, performed for 15 minutes over three consecutive days, twice a day on an empty stomach. Swedish massage included strokes, effleurage, vibration and kneading. The mean score of nausea in the intervention group was lower than in the control group immediately after the intervention. However, after one week of intervention, the mean scores of nausea and vomiting did not differ. Abdominal massage with or without Salvia officinalis had little effect on reducing nausea and vomiting in cancer patients undergoing chemotherapy. Another study integrated electrical stimulation with traditional Chinese medicine (Mao, et al. 2021). Transcutaneous acupoint electric stimulation (TAES) and gastric electrical stimulation (GES) were given to lung cancer patients receiving chemotherapy. It was shown that TAES and GES were effective in relieving GI discomfort, including nausea and vomiting, in lung cancer patients after treatment.

Conclusion

Several studies have highlighted the management of nausea and vomiting using non-pharmacological interventions, such as self-management strategies. Such strategies can be undertaken through dietary and environmental modifications, psychological strategies, and other strategies (exercise, abdominal massage, etc.). The interventions discussed in this article can be applied by patients as directed or instructed by healthcare teams. Nurses play an important role in educating patients on non-pharmacological interventions and encouraging them to achieve self-efficacy. Further research or exploration of other non-pharmacological interventions with larger sample sizes or better methodologies are needed to provide more accurate results. Case studies regarding such interventions could also be conducted to support their application in daily practice.

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