

Physiotherapeutic Action on Chemotherapy and Radiotherapy Adverse Effects in Cancer Patients: Systematic Literature Review

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Atuação Fisioterapêutica nos Efeitos Adversos da Quimioterapia e Radioterapia em Pacientes Oncológicos: Revisão Sistemática da Literatura

Papel Fisioterapêutico en los Efectos Adversos de la Quimioterapia y Radioterapia en Pacientes Oncológicos: Revisión Sistemática de la Literatura

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ABSTRACT

Introduction: Cancer arises from a series of genetic mutations due to exposure to carcinogens that compromise the immune defenses and, as it progresses, treatments as chemotherapy and radiotherapy are adopted. However, both treatments cause adverse effects and physiotherapy has the objective of rehabilitating functional kinetic dysfunctions resulting from these effects. **Objective:** To systematize the most utilized physiotherapeutic approaches to treat the main adverse effects arising from chemotherapy and radiotherapy in cancer patients. **Method:** A systematic review was carried out in the PubMed, LILACS, PEDro and SciELO databases from 2017 to 2022. **Results:** Of the 4,190 articles, 13 were selected that met the inclusion criteria and scored 6/10 on the PEDro Scale. The physiotherapeutic procedures reported in the studies were acupuncture, laser, led, therapeutic massage, auriculotherapy, cryotherapy and osteopathy, which promoted a decrease and relief of adverse effects and could act as mitigating factors in the occurrence of these symptoms. **Conclusion:** Adverse effects as nausea and vomiting, mucositis and fatigue secondary to chemotherapy and radiotherapy can be treated with physiotherapeutic procedures as acupuncture, laser, led, therapeutic massage, auriculotherapy, cryotherapy and osteopathy, which are safe and effective for this profile of patient, in addition to providing symptoms relief, preventing and reducing inflammatory processes, increasing appetite, improving gastrointestinal function and physical conditioning.

Key words: neoplasms; drug therapy; radiotherapy; physical therapy modalities.

RESUMO

Introdução: O câncer surge a partir de séries de mutações genéticas em razão da exposição a agentes cancerígenos que comprometem a defesa imunológica e, com seu avanço, são utilizados tratamentos como a quimioterapia e a radioterapia. Entretanto, ambos os tratamentos provocam efeitos adversos. Dessa forma, a fisioterapia tem o intuito de reabilitar as disfunções cinético-funcionais provenientes desses efeitos. **Objetivo:** Sistematizar as condutas fisioterapêuticas mais utilizadas para tratar os principais efeitos adversos oriundos da quimioterapia e radioterapia em pacientes oncológicos. **Método:** Revisão sistemática nas bases de dados PubMed, LILACS, PEDro e SciELO no período de 2017 a 2022. **Resultados:** Dos 4.190 artigos, foram selecionados 13 que preencheram os critérios de inclusão e nota 6/10 pela Escala PEDro. As condutas fisioterapêuticas relatadas nos estudos foram acupuntura, laser, led, massagem terapêutica, auriculoterapia, crioterapia e osteopatia, que promoveram diminuição e alívio dos efeitos adversos, podendo atuar como atenuantes na ocorrência desses sintomas. **Conclusão:** Os efeitos adversos como náuseas e vômitos, mucosite, e fadiga, secundários à quimioterapia e radioterapia, poderão ser tratados com condutas fisioterapêuticas como acupuntura, laser, led, massagem terapêutica, auriculoterapia, crioterapia e osteopatia, que são seguras e efetivas para esse perfil de pacientes, além de proporcionar alívio dos sintomas, prevenir e diminuir os processos inflamatórios, aumentar o apetite, melhorar a função gastrointestinal e o condicionamento físico. **Palavras-chave:** neoplasias; tratamento farmacológico; radioterapia; modalidades de fisioterapia.

RESUMEN

Introducción: El cáncer surge de una serie de mutaciones genéticas debidas a la exposición a agentes cancerígenos que comprometen las defensas inmunitarias, y a medida que avanza se utilizan tratamientos como la quimioterapia y la radioterapia. Sin embargo, ambos tratamientos provocan efectos adversos. De esta forma, la fisioterapia surge con la intención de reabilitar las disfunciones cinéticas funcionales resultantes de estos efectos. **Objetivo:** Sistematizar los enfoques fisioterapêuticos más utilizados para tratar los principales efectos adversos derivados de la quimioterapia y radioterapia en pacientes oncológicos. **Método:** Revisión sistemática en las bases de datos PubMed, LILACS, PEDro y SciELO de 2017 a 2022. **Resultados:** De los 4190 artículos, solo se seleccionaron 13 que cumplieron con los criterios de inclusión y recibieron una puntuación de 6/10 en la escala PEDro. Los procedimientos fisioterapêuticos reportados en los estudios fueron acupuntura, láser, led, masaje terapêutico, auriculoterapia, crioterapia y osteopatia, que promovieron una disminución y alivio de los efectos adversos y podrían actuar como mitigantes en la aparición de estos síntomas. **Conclusión:** Los efectos adversos como náuseas y vómitos, mucositis y cansancio secundarios a la quimioterapia y radioterapia pueden ser tratados con procedimientos fisioterapêuticos como acupuntura, láser, led, masaje terapêutico, auriculoterapia, crioterapia y osteopatia, los cuales son seguros y efectivos. en estos perfiles de pacientes, además de proporcionar alivio de síntomas, prevenir y reducir procesos inflamatorios, aumentar el apetito, mejorar la función gastrointestinal y la condición física. **Palabras clave:** neoplasias; quimioterapia; radioterapia; modalidades de fisioterapia.

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INTRODUCTION

Cancer is a term that covers several histological types of malignant neoplasms, whose cells have disordered and harmful growth to the host, with a high capacity to invade and disseminate both tissues and organs. Its development occurs through several series of genetic mutations that are partially or totally beyond the regulatory control of the immune system, with the ability to evade, apoptosis, insensitivity to signs of growth inhibition and promotion of sustained angiogenesis for its nutrition¹.

Cancer arises through changes in the genetic material in the nucleus of cells, going through stages of initiation, promotion and progression, a process known as carcinogenesis, influenced by the time and burden of exposure to carcinogens to develop, affecting any part of the body. From the appearance of the first signs and/or symptoms to the clinical and pathological diagnosis can take about months or years, depending a lot on the reproduction capacity of the cancer cell and the diagnostic method applied for detection².

The most recent global estimate in 2020 warns of a high incidence of cancer in the world, totaling 19.3 million new cases (18.1 million, if cases of non-melanoma skin cancer are excluded)³. In Brazil, according to the estimate of the National Cancer Institute (INCA)², for each year of the 2023-2025 triennium, there will be 704,000 new cases of cancer. Non-melanoma skin cancer will be the most frequent with about 31.3% incidence. Therefore, the disease still remains on the world stage among those that most lead patients to death⁴.

The proposed oncological treatments will depend on the clinical stage in which the patient is at the time of diagnosis, having as treatment methods chemotherapy, radiotherapy, immunotherapy, hormone therapy and oncological surgery, of local or systemic action. The main objectives of this treatment are to prevent the progression of the disease, to inactivate or decrease the aggressiveness of the cancer⁵.

However, some treatments and dosages can generate adverse effects, causing changes in the performance of the immune system as well as dysfunctions in other vital systems in the patient's body. To seek to minimize adverse effects during treatments, but, at the same time, combat the progression of cancer, constant dilemmas arise in the daily lives of professionals and patients⁶.

What is known is that the negative repercussions of these effects have a direct impact on daily, financial and work life, especially when it comes to the individual's functionality. In the literature, the main treatments that most lead to the appearance of adverse effects are already detailed: chemotherapy and radiotherapy^{7,8}.

Chemotherapy is a systemic treatment that acts in the process of cell division preventing or delaying this event from happening, while radiotherapy has a more local effect using ionizing radiation. Among the main undesirable effects are adverse effects that are frequently reported by the patient during or after cancer treatment, such as nausea, dizziness, pain, mucositis, radiodermatitis and fatigue⁸.

Monitoring by a specialized multidisciplinary team is of vital importance for better decision-making about the treatment to be performed and, among professionals, the physiotherapist is responsible for performing kinetic-functional rehabilitation due to dysfunctions arising from cancer, thus aiming at a faster return to functional activities, since most patients are in the professional active age group^{9,10}.

Studies^{11,12} on the role of physiotherapy in the adverse effects of oncological treatments show that physiotherapy promotes, through its conducts, analgesia, reduction of oncological fatigue and acts on dermatological dysfunctions as well as on nausea and vomiting. However, when comparing Brazilian physiotherapists to those from the rest of the world, there was a delay in accessing the latest in equipment, in the new possibilities of therapeutic conduct involving cancer patients, as well as in clinical research, although the advance in new publications is still not enough, so the information needs to be more clarified and accessible. There is a need for more specific details so that professionals can make more assertive choices according to their local reality and monitor updates for physiotherapeutic oncology treatment.

The objective of this study is to systematize the most used physiotherapeutic approaches to treat the main adverse effects arising from chemotherapy and radiotherapy in cancer patients.

METHOD

This is a systematic review on physiotherapeutic action on the adverse effects of chemotherapy and/or radiotherapy in cancer patients, registered by CRD number 42022334622 in the *International Prospective Register of Systematic Reviews* (PROSPERO) according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)¹³.

The literature search took place from June to November 2022 in the electronic databases: PubMed, lilacs, PEDro and SciELO, including original randomized clinical trials published in English, Spanish and Portuguese, from 2017 to 2022 and in humans. For the search strategy of the main adverse effects of both chemotherapy and/or radiotherapy, the Descriptors in Health Sciences (DeCS) such as nausea,

mucositis, fatigue, therapy, neoplasia, chemotherapy and radiotherapy, and their correlates in English, were applied.

The following combinations were used through the *Medical Subject Headings* (MeSH): therapeutics OR therapeutics AND nausea OR nausea, mucositis OR mucositis AND neoplasia AND neoplasms, fatigue OR fatigue OR fatigue AND neoplasia AND neoplasms. However, in some databases, there was a need for adaptations, such as PEDro, in which only the following health descriptors were used: radiotherapy nausea*, radiotherapy fatigue*, chemotherapy nausea*, chemotherapy fatigue*, radiotherapy mucositis* and chemotherapy mucositis*. While in lilacs were used: treatment for cancer nausea, treatment for mucositis and treatment for fatigue and chemotherapy; in SciELO: treatment for cancer nausea, treatment for mucositis and treatment of cancer fatigue.

The first evaluation of the articles was by reading the titles and abstracts, after being in accordance with the inclusion criteria: randomized clinical trials in which patients presented adverse effects during or after chemotherapy and/or radiotherapy, being treated with physiotherapeutic procedures, neoplasms at any stage of the disease, published in the last five years. Exclusion criteria: articles that had conduct performed by other professional specialties, drug therapy to treat adverse effects, animal or *in vitro* studies and systematic reviews.

The eligibility of the studies was evaluated by two independent evaluators, and, in case of disagreement, there was a third evaluator for tiebreaker. For the methodological evaluation of the studies, the Portuguese (Brazil) PEDro scale was used, which helps researchers to identify in the studies whether their results can be interpreted and whether they have internal methodological validity, containing criteria from 1 to 11: 1 – assesses whether the eligibility criteria were specified; 2 – whether the subjects were randomly distributed by groups (in a *crossover* study, the subjects were randomly placed in groups according to the treatment received); 3 – whether the distribution of the subjects was blinded; 4 – whether initially the groups were similar with regard to the most important prognostic indicators; 5 – whether all subjects participated blindly in the study; 6 – whether all physiotherapists who administered the therapy did so blindly; 7 – whether all assessors who measured at least one key outcome did so blindly; 8 – whether measurements of at least one key outcome were obtained in more than 85% of subjects initially distributed among the groups; 9 – whether all subjects from whom they presented outcome measurements received the treatment or control condition according to the distribution or, when this was not the

case, data analysis was performed for at least one of the key outcomes by “intention to treat”; 10 – whether the results of the intergroup statistical comparisons were described for at least one key outcome; and 11 – whether the study presented both precision measures and variability measures for at least one key outcome. This way, the score will only be assigned when a criterion is clearly met.

The articles evaluated by the PEDro scale with a score lower than 6/10 were not included in the present study, as these, containing scarce methodology and analysis, may generate doubtful information about the outcomes found and subject to errors, compromising the quality of the study.

RESULTS

When searching for articles in the databases, the following articles were found: PubMed (n=3,997), PEDro (n=322), SciELO (n=14) and lilacs (n=13), totaling 4,346 articles found. Of these, those who addressed nausea were (n=3,034), mucositis (n=772) and fatigue (n=540). The first evaluation was through the reading of titles and abstracts, excluding a total of 4,190 articles: duplicates (n=139), out of theme (n=2,300), in use of drug therapy (n=400), conduct of other specialties (n=16), and did not address the adverse effects (n=1,474), leaving for full reading 17 articles to be evaluated by the PEDro Scale (Figure 1).

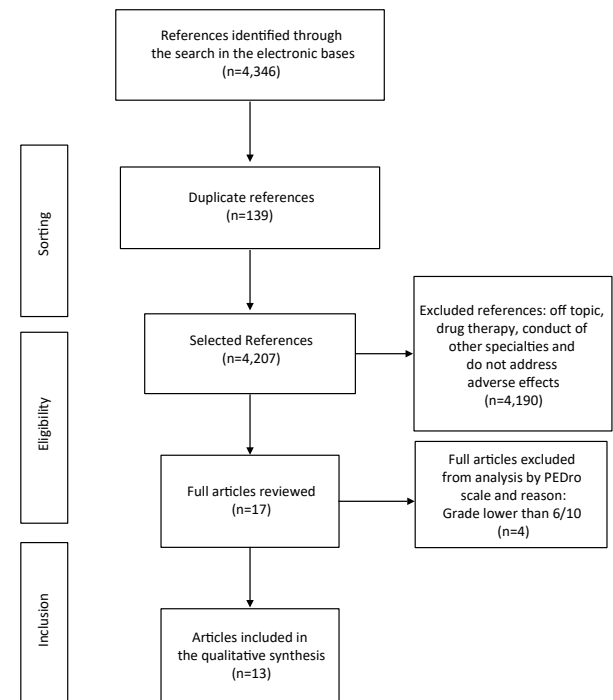


Figure 1. PRISMA flowchart – study selection process
Source: adapted from PRISMA 2020¹³.

For qualitative evaluation of the articles, the PEDro scale with a cutoff point of 6/10 was applied. After evaluation, 13 articles were selected: seven on nausea and vomiting¹⁴⁻²⁰, four on mucositis²¹⁻²⁴ and two on fatigue^{25,26} for qualitative analysis of the study. The articles that addressed the treatment for nausea and vomiting associated with chemotherapy were from profiles of patients with breast cancer^{18,19,27} (three studies), lymphoma¹⁶, gastric¹⁵, osteosarcoma, rhabdomyosarcoma and Ewing's sarcoma¹⁴ and gynecological/colorectal¹⁷.

The types of cancers of the oral cavity^{21,22} (two studies), leukemia²³ and solid²⁴ had the study population that developed oral mucositis after chemotherapy and radiotherapy, while fatigue was related to breast cancer²⁵ and gastrointestinal cancer²⁶. When analyzing the data of the selected articles, it was evidenced that patients with breast cancer are more susceptible to developing adverse effects, such as those reported.

The information on the clinical methodology evaluated in the studies by the PEDro scale is contained in Chart 1 with a score from 1 to 11, being answered yes or no. Table 1 describes, in increasing order of appearances, the adverse effects: nausea and vomiting, followed by mucositis and fatigue, and the selected studies demonstrating which conducts were applied, time of use, parameters and techniques chosen for the treatment of

adverse effects in patients undergoing chemotherapy and/or radiotherapy.

DISCUSSION

In the present systematic review, adverse effects secondary to chemotherapy and radiotherapy were treated with physiotherapeutic resources evidenced in the protocols of the reviewed articles. The reports brought as conducts acupuncture with electrostimulation, light amplification by stimulated emission of radiation (laser), light emitting diode (led), osteopathy, cryotherapy, massage and auriculotherapy related to nausea and vomiting, mucositis and fatigue in cancer patients.

Some studies^{14,16,17} addressed acupuncture with electrostimulation at acupoints ST36 and CV12. In these articles, in the outcomes found, there was a decrease or relief of the symptoms of nausea and vomiting after the fifth day of the third or fifth cycle of chemotherapy, regardless of the point to be chosen, not requiring high frequency of use of antiemetics and reducing daily consumption, so the physiotherapist can choose this conduct in order to mitigate these effects before the exercises and provide prolonged well-being, however the professional will need to specialize. Another study¹⁵ demonstrated that, in patients with gastric cancer, there

Chart 1. Evaluation of studies by the PEDro scale

Author (year)	1	2	3	4	5	6	7	8	9	10	11*	PEDro Score
Zorba, Ozdemir, 2018	S	S	S	S	S	N	N	S	S	S	S	8/10
Varejão, Santos, 2019	S	S	S	S	S	N	N	S	S	S	S	8/10
Chen et al., 2017	S	S	S	N	S	N	N	S	N	S	S	6/10
Aybar, Kilic, Çinkir, 2020	S	S	S	N	S	N	N	N	S	S	N	5/10
Lagrange et al., 2019	S	S	S	S	N	N	N	S	S	S	S	7/10
Widgren, Enblom, 2017	S	S	N	N	S	N	S	S	S	S	N	6/10
Tan et al., 2022	S	S	S	N	N	N	S	N	S	S	S	6/10
Guo, Wang, 2018	S	S	S	N	N	N	S	N	S	S	S	6/10
Legouté et al., 2019	S	S	S	N	S	S	S	N	S	S	S	8/10
Alizadeh et al., 2021	S	S	N	S	N	N	N	S	S	S	N	6/10
Rodrigues et al., 2020	S	S	S	N	N	N	S	N	S	S	S	6/10
Kauark et al., 2022	S	S	S	S	S	N	N	N	S	S	N	7/10
Guimaraes et al., 2021	S	S	N	N	S	N	N	N	S	S	S	6/10
Bahceli, Arslan, Ilik, 2022	S	S	S	S	N	N	N	N	S	S	N	6/10
Khanghah et al., 2019	S	S	N	N	N	N	N	S	S	S	S	5/10
Jaya, Thakur, 2020	N	S	S	S	N	N	N	N	S	S	N	5/10
Asha, Manjini, Dubashi, 2020	N	S	N	S	N	N	N	S	S	S	S	5/10

Captions: Y = Yes; N = No.

(*) Criterion 11, despite being evaluated, was not included as a method for final grade in the score of the studies.

Table 1. Studies demonstrating the conducts applied to the treatment of adverse effects: nausea and vomiting, mucositis and fatigue related to chemotherapy and/or radiotherapy, intervention, parameters, and outcomes used in cancer patients

Author (year)	Study outline	PE德罗 scale	Adverse effects	Type of neoplasm/objective	Intervention/parameters	Outcomes
Tan et al., 2022 ¹⁹	Clinical Trial	6/10	Nausea	Breast cancer Objective: To examine the effects of auriculotherapy on nausea in breast cancer patients undergoing QT	Sample: 114 GAT (n=76): GAT (n=38): performed from the 1st to the 5th QT cycle, seven points were chosen: "Cardia", "Stomach", "Spleen", "Liver", "Shenmen", "Sympathetic" and "Subcortex", instructed to press the seeds until a feeling of heaviness, pain, distension or tingling, 3 times a day in the morning, afternoon and night, lasting 4 to 7 minutes each, adding pressure to all seeds Simulated GAT (n=38): the same acupuncture points without pressure, and the seeds were exchanged for others without medicinal effects, duration equal to that of the intervention GTP (n=38): drug treatment	The use of auriculotherapy was superior to the use of standard antiemetic treatment and isolated care in the management of nausea and vomiting among breast cancer patients receiving QT. The antiemetic effects of auriculotherapy appear to be more profound in improving acute nausea
Varejão; Santos, 2019 ¹⁴	Clinical Trial	8/10	Nausea	Osteosarcoma, rhabdomyosarcoma and Ewing's sarcoma in children Objective: To evaluate the efficacy of laser acupuncture in relieving nausea and vomiting in children and adolescents undergoing laser treatment	Sample 17 GLA (n=7): visible red laser acupuncture, variable and continuous stimulation frequency, wavelength of 660 nm and power density of 30 mW/3 J at the points, performed on the first day of each cycle Exposure of 1 min for each point, totaling 6 min of application, before the start of QT administration GP (n=10): laser acupuncture at the same points, but turned off with a duration of 6 min	Laser acupuncture was effective in relieving nausea during the 5 days post QT and relieving vomiting on days 2 and 3 post QT
Lagrange et al., 2019 ²⁰	Clinical Trial	7/10	Nausea	Breast cancer Objective: To determine the impact of visceral osteopathy on the incidence of nausea/vomiting, constipation and overall quality of life in women operated for breast cancer and undergoing adjuvant QT at the Georges François Leclerc Center	Sample: 69 GO (n=41): visceral manipulation consisting of muscle relaxation of the chest wall and diaphragm by means of manual chest compression, for 15 min, after each of the 3 initial QT cycles GP (n=28): manipulation of superficial/soft tissues without action on the chest wall and abdominal structures; the intensity of compression was reduced in this group to avoid any manipulation of the diaphragm and intercostal muscles	Osteopathy does not reduce the incidence of nausea/vomiting in women operated for breast cancer and undergoing adjuvant QT. In contrast, patients reported that digestive quality of life was significantly improved by osteopathy

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Table 1. continuation

Author (year)	Study outline	PE德罗 scale	Adverse effects	Type of neoplasm/objective	Intervention/parameters	Outcomes
Zorba; Ozdemir, 2018 ¹⁸	Clinical Trial	8/10	Nausea	Breast cancer Objective: To evaluate the feasibility and preliminary effects of massage and inhalation aromatherapy on acute QT-induced nausea/vomiting	Sample: 75 GM (n=25): foot massage, using techniques of: effleurage of the back, top, bottom and petrissage of the top, 20 min in total (10 min per foot) plus 2 ml of essential oil mixture, for 20 min before the start of QT GI (n=25): a cotton sponge, soaked in 2 ml mixed with essential oil, at the tip of the patient's nose, asked to inhale for 3 min, with normal breathing and 5 min before the start of QT GP (n=25): did not receive any treatment other than treatment procedures and routine care	The incidence of nausea and vomiting was significantly higher in the CG than in the other groups in the 3rd and 4th QT cycles. In addition, in these 2 cycles, the incidence of nausea and vomiting craving was significantly lower in the MG than in the IG The severity of nausea was significantly lower among patients in the GM and inhalation than in the CG in all 3 cycles
Guo; Wang, 2018 ¹⁵	Clinical Trial	6/10	Nausea	Gastric Cancer Objective: To evaluate the efficacy of electrical nerve stimulation for the treatment of QT-induced nausea and vomiting in patients with advanced gastric cancer	Sample: 124 Gae (n=62): electroacupuncture with bilateral points (P6), Zusanli (ST36) and Hegu (LI4) for 30 min daily, 7 times a week for a total of 1 week, frequency from 2 to 100 Hz, within a maximum tolerance intensity of each individual GAS (n=62): treated at the same acupoints, with the same treatment period as Gae, except no electrical stimulation was applied	Results demonstrated that electrostimulation acupuncture is safe and effective for nausea and vomiting in patients with gastric cancer after treatment. They showed that electrostimulation acupuncture can not only decrease the severity of nausea and vomiting, but also increase appetite for gastric cancer patients when compared to GAS In addition, no adverse events related to Gae treatment were detected
Widgren, Enblom, 2017 ¹⁷	Clinical Trial	6/10	Nausea	Gynecological, colorectal and other cancers Objective: To study nausea, vomiting, and the need for rescue antiemetics in patients receiving concurrent pelvic radiotherapy during QT	Sample: 68 Gag (n=57): for 4 weeks GA (n=28): administered bilaterally to point PC6, 3 times per session, rotating and getting up GAS (n=29): used a fake needle, away from the PC6 point GTP (n=11): drug treatment	Patients treated with acupuncture experienced milder nausea than other patients in the other groups and when they needed to take antiemetics compared to drug treatment they were on a low dose
Chen et al., 2017 ¹⁶	Clinical Trial	6/10	Nausea	Lymphoma Objective: To evaluate the effects of acupuncture after QT to offer biological plausibility to treat vomiting and nausea	Sample: 160 TG (n=120): Acupuncture needles were inserted and manipulated until the sensation of pain and tingling then connected at 2 Hz below 10 mA, total duration of 30 to 60 min, before the start of QT, for 4 consecutive days Single group ST36 (distal) = 40 Single group CV12 (local) = 40 Corresponding group ST36-CV12 (distal proximal) = 40 GC (n=40): will receive only an anti-emetic regimen	There was a decrease in the incidence of nausea with acupuncture in the 3 groups when compared to the CG, but not significant to say which was the best among them

to be continued

Table 1. continuation

Author (year)	Study outline	PEDro scale	Adverse effects	Type of neoplasm/objective	Intervention/parameters	Outcomes
Kauark et al., 2022 ²²	Clinical Trial	7/10	Mucositis	Squamous cell carcinoma of the oral cavity and oral part of pharynx Objective: To evaluate the safety and efficacy of prophylactic extraoral Photobiomodulation for the prevention of oral and oropharyngeal mucositis on clinical outcomes and survival	Sample: 50 GFT (n=29): led was applied to the face and neck for 60 seconds, at five sites (50 mW/cm ² × 60 s = 3.0 J/cm ² per site) GP (n=26): an inactivated probe was applied to the patient's face and neck for 60 seconds	Photobiomodulation by led was well tolerated and caused no significant adverse effects. Suggesting the indication of prophylactic led to prevent the early onset of oral mucositis, as well as reduce pain levels and the need for analgesics and anti-inflammatories
Guimaraes et al., 2021 ²³	Clinical Trial	6/10	Mucositis	Acute lymphoblastic leukemia in children Objective: To compare the efficacy of laser or led Photobiomodulation for the prevention and treatment of oral mucositis in pediatric patients undergoing QT	Sample: 80 GL (n=40): laser with wavelength 660 nm, output power (mW) = 100 and duration of exposure per area (seconds) = 36 GLED (n=40): led wavelength 660 nm, output power (mW) = 5 and exposure duration per area (seconds) = 120 The applications were performed every day once a day at approximately the same time and started at D0 of the QT cycle and ended until hospital discharge	Led is a safe and low-cost alternative tool when compared to laser, however both light sources showed equivalent effects in the prevention of oral mucositis induced by high doses of QT
Rodrigues et al., 2020 ²⁴	Clinical Trial	6/10	Mucositis	Solid cancer Objective: to evaluate the effect of oral cryotherapy compared to saline on the development of oral mucositis in outpatients using the antineoplastic 5-fluorouracil	Sample: 60 GCA (n=30): application of ice in the oral cavity, starting 5 min before QT infusion, 30 min of continuous administration, in which patients receive pieces of ice for individual use GHB (n=30): they were instructed to perform mouthwashes with 10 ml of saline, at room temperature, 3 times a day, for 1 min and for a period of 14 days after the application of the chemotherapeutic	Although cryotherapy did not obtain statistical significance, when compared to the oral hygiene protocol with saline solution, it proved to be effective intragroup. The inclusion of outpatient cryotherapy for patients undergoing treatment with QT may be an alternative to reduce the occurrence and severity of mucositis, with few side effects, acting as a preventive strategy for oral mucositis
Legouté et al., 2019 ²¹	Clinical Trial	8/10	Mucositis	Oral or hypopharyngeal cancer Objective: To evaluate the efficacy of a 100 mW and 658 nm laser for the prevention and treatment of QT-induced mucositis and concomitant radiotherapy in patients with advanced oral or oro/hypopharyngeal cancer	Sample: 51 GL (n=26): He-Ne HETSCHL [®] laser (lambda = 658 nm, output = 100 mW and energy density = 4 J/cm ²), irradiation time 40 s/cm ² > 1 session/day, 5 times/week from the day of occurrence of grade II mucositis to the day of resolution of grade II mucositis GS (n=25): simulated laser, in which energy density = 0 J/cm ² and irradiation time = 10 s/cm ²	Low-intensity laser therapy was well tolerated with a good safety profile, which favors its use in clinical routine for treatment of severe mucositis

to be continued

Table 1. continuation

Author (year)	Study outline	PEDro scale	Adverse effects	Type of neoplasm/objective	Intervention/parameters	Outcomes
Bahceli, Arslan, Ilik, 2022 ²⁵	Clinical Trial	6/10	Fatigue	Breast cancer Objective: To investigate the effect of slow back massage on the level of fatigue in women with breast cancer undergoing QT	Sample: 64 GM (n=32): slow, gentle and rhythmic back massage, a total of 20 min, 10 min before and after each QT infusion (2nd, 3rd and 4th cycles) GTP (n=32): routine treatment: analgesic medications and basic daily activities	Slow back massage applied from the 2nd cycle of the QT protocol significantly reduced the level of fatigue
Alizadeh et al., 2021 ²⁶	Clinical Trial	6/10	Fatigue	Gastrointestinal Cancer Objective: To investigate the effect of massage therapy on fatigue after chemotherapy in patients with gastrointestinal cancer	Sample: 88 GM (n=44): bilateral foot to knee massage, lasting 40 min during the QT cycle CG (n=44): They went through all processes in the same way, except for not receiving foot massage during QT	Massage therapy can significantly reduce fatigue in the intervention group compared to the CG

Captions: GM = massage group; GI = inhalation group; GC = control group; QT = chemotherapy; min = minutes; GLA = laser acupuncture group; GP = placebo group; GO = osteopathy group; TG = treatment group; GA = acupuncture group; GTP = standard treatment; GAT = auriculotherapy group; Gae = electrostimulation acupuncture group; GAS = simulated acupuncture group; GL = laser group; GS = simulated laser group; GFT = Photobiomodulation group; GCA = cryotherapy group; GHB = oral hygiene group; GLED = led group.

was an increase in appetite after electroacupuncture. Asthenia and low nutritional intake are some of the main limiting factors for the progression of motor conducts, such as regular exercise, since such patients have low tolerance, resulting from adverse effects as a result of antineoplastic treatment.

Two other conducts addressed were auriculotherapy¹⁹ and foot massage with effleurage and *petrissage* techniques¹⁸. Both showed efficacy in preventing and reducing nausea and vomiting, collaborating with the results found in another study²⁸, thus considering safe, effective, and low-cost interventions performed by physiotherapists who dominate them, having a positive impact on social and work life, and capable of providing a sense of well-being and self-care.

In only one study²⁰, visceral manipulation was approached using osteopathic techniques, a physiotherapeutic specialty for the treatment of nausea and vomiting. Although it did not demonstrate a statistically significant result for the reduction of these adverse effects, there were reports from patients of improvement in digestive quality and function after the conduct. Thus, the osteopathic techniques used seem to promote secondary reduction of these symptoms and others such as constipation and loss of appetite, including the occurrence of these symptoms is often reported by cancer patients during physiotherapy sessions²⁰.

Thus, the aforementioned treatments, in general, for nausea and vomiting during and after chemotherapy, become options for conduct that can be used by physiotherapists in order to treat these adverse effects, provided that the professional specializes. In addition, none of these treatments posed risks to the general health of patients; thus, the interdisciplinary team is of vital importance to contribute to these conducts being offered to cancer patients from the basic health unit to high complexity, working together for better decision-making according to the individuality and therapeutic proposal of each individual, since there is a shortage between the offer and the performance of physiotherapeutic treatments, so that the non-synergism among professionals negatively impacts functional capacity, generating dysfunctions, limitations of mobility and functional losses.

The other adverse effect studied was oral mucositis from chemotherapy or radiotherapy treatment in profiles of patients with oral cancer^{21,22} (two studies), lymphoblastic leukemia²³ and solids²⁴, in which the proposed physiotherapeutic treatment was the low-power laser with parameters of 658-660 nm, 4J with duration ranging from 36 to 40 seconds, whose treatment protocol proved to be well tolerated and daily, which favored the reduction of oral mucositis, including severe^{21,23}. Another conduct applied was led with parameters of 50 mW/cm² for 60 seconds, which proved to be beneficial in reducing

pain and inflammation of the oral mucosa, since it usually requires the constant and sometimes large-scale use of analgesics and anti-inflammatories²². Thus, laser and led appear as new treatment options for these patient profiles and with a rapid resolution response, corroborating the data that demonstrate the beneficial effects also in the prevention of chemotherapy-induced oral mucositis²³.

Cryotherapy was also applied to treat mucositis using ice cubes for five minutes prior to chemotherapy. The clinical outcome was the reduction of the occurrence and severity of mucositis, acting in a preventive way or attenuating the severity of the lesion, in addition to being a low-cost and easy access to patients²⁴.

Fatigue was studied in two studies, one with patients with breast cancer²⁵ and the other, gastrointestinal²⁶. In both, massage therapy was the chosen conduct, in the feet to the knees and, in another study, in the back, varying in duration between 20 and 40 minutes. Before and after chemotherapy, the results found say that massage in these regions provided a significant reduction in the level of fatigue, as well as its perception after chemotherapy cycles from the second cycle.

Regarding the age of the patients benefited, most studies were in adults, only in two studies^{14,23} the protocols were with pediatric patients aged 4 to 17 years who presented nausea and vomiting associated with chemotherapy or radiotherapy, in which they used laser acupuncture^{14,21,23} and photobiomodulation^{22,23} for mucositis. Both techniques proved to be resolute and promoted the reduction of these adverse effects, being safe conduct for this age group.

Regarding the disease profile of patients *versus* adverse effects of cancer treatments, it was observed that most of the studies found involved patients with breast cancer^{19,25,27}, being the most affected and those who developed nausea and vomiting after chemotherapy, followed by oral cancer^{21,22}, linked to mucositis after cycles of radiotherapy or chemotherapy, due to being a neoplasm restricted to the oral cavity or neck region in which the mucosa and head and neck regions are more prone to infections and inflammation. Finally, fatigue can be developed in any profile of cancer patients, due to the neoplastic process and the treatment associated with low nutritional intake, since, in the neoplastic process, cancer cells retain supplies and energy sources for themselves, while, for other functionalities, normal cells acquire limitations and inability to adequately maintain their functioning, thus leading to functional decline²⁸.

The search for less harmful conducts to the patient's body is one of the main objectives when talking about therapies during cancer treatment, since patients suffer both from neoplastic treatment and from the adverse

effects of therapies, so this research allowed specifying which physiotherapeutic conducts can be applied with scientific evidence, corroborating the clinical practice for each effect studied, specifying the time of use, parameters, points of application and techniques.

Physiotherapy in oncology since 2009 has been considered a specialty, with the aim of contributing to the reestablishment of function, the improvement of physical conditioning, the reduction of inflammatory and painful processes, allowing patients to have their functionality adapted and reestablished, so that all the conducts found can be applied to cancer patients, safely and effectively, since the clinical outcomes of the protocols, during and after treatment, were able to provide the reduction or acted in the prevention of adverse effects arising from chemotherapy and/or radiotherapy, being revalidated by other studies^{29,30}.

As a limitation of the study, although there are good protocols in the literature regarding the applicability of these conducts in the treatment of the studied adverse effects, there is still a dependence on the previous knowledge about cancer of the professional who will work with this population to know how to direct the best conducts to each case, thus requiring them to qualify to propose and carry out the treatment safely. In addition, the methodological protocols observed in some articles do not allow to ensure that all forms of blinding were performed properly, and, in such a way, the results have to be analyzed critically.

CONCLUSION

Adverse effects such as nausea and vomiting, mucositis and fatigue, secondary to antineoplastic treatment, such as chemotherapy and radiotherapy, can be safely and effectively treated with physical therapy, including acupuncture, laser, led, massage therapy, auriculotherapy, cryotherapy and osteopathy in cancer patients during and after chemotherapy and/or radiotherapy. In addition to providing relief, prevention and reduction of inflammatory processes, they promote increased appetite, improved gastrointestinal function and physical fitness.

CONTRIBUTIONS

All authors contributed substantially to the design and/or planning of the study; in the collection, analysis and interpretation of data; in the writing and critical review with intellectual contribution; and approved the final version to be published.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interest to declare.

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