



NICOLAUS COPERNICUS
UNIVERSITY
IN TORUŃ



Quality in Sport. eISSN 2450-3118.

Journal Home Page

<https://apcz.umk.pl/QS/index>

SAVCHAK, Tetiana, IVANCHUK, Sofiia, KAMINSKAYA, Anhelina, KUREK, Aleksandra, FERETYCKI, Hubert, GŁOWACKA, Aleksandra, GÓRECKI, Patryk, KOZICKI, Maciej, SALAMA, Aladdin, DOMIŃCZAK, Dominika and ABDULLA, Shafea. Therapeutic effects of yoga and mindfulness on cancer-related pain: a literature-based review. Quality in Sport. 2026;53:70068. eISSN 2450-3118. <https://doi.org/10.12775/QS.2026.53.70068>

The journal has been awarded 20 points in the parametric evaluation by the Ministry of Higher Education and Science of Poland. This is according to the Annex to the announcement of the Minister of Higher Education and Science dated 05.01.2024, No. 32553. The journal has a Unique Identifier: 201398. Scientific disciplines assigned: Economics and Finance (Field of Social Sciences); Management and Quality Sciences (Field of Social Sciences).

Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych). © The Authors 2026.

This article is published with open access under the License Open Journal Systems of Nicolaus Copernicus University in Toruń, Poland. Open Access: This article is distributed under the terms of the Creative Commons Attribution Noncommercial License, which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non-commercial Share Alike License (<http://creativecommons.org/licenses/by-nc-sa/4.0/>), which permits unrestricted, non-commercial use, distribution, and reproduction in any medium, provided the work is properly cited.

The authors declare that there is no conflict of interest regarding the publication of this paper.

Received: 21.03.2026. Revised: 30.03.2026. Accepted: 30.03.2026. Published: 03.04.2026.

THERAPEUTIC EFFECTS OF YOGA AND MINDFULNESS ON CANCER-RELATED PAIN: A LITERATURE-BASED REVIEW

Authors:

Tetiana Savchak* (Corresponding author)

Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland.

tianasavchak02@gmail.com

<https://orcid.org/0009-0002-6829-1281>

Sofiia Ivanchuk

Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland.

sonyaivanchuk@gmail.com

<https://orcid.org/0009-0007-0008-053X>

Anhelina Kaminskaya

Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland.

kam.angelina1977@gmail.com

<https://orcid.org/0009-0002-1900-1778>

Aleksandra Kurek
Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland.
aleksandrakurek01@gmail.com
<https://orcid.org/0009-0008-9666-6638>

Hubert Feretycki
Cardinal Stefan Wyszyński University in Warsaw, 5 Dewajtis Street, 01-815 Warsaw, Poland
h.feretycki@gmail.com
<https://orcid.org/0009-0000-6497-4451>

Aleksandra Głowacka
Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland
a.glowacka@interia.pl
<https://orcid.org/0009-0009-2141-4978>

Patryk Górecki
Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland
gpatryk631@gmail.com
<https://orcid.org/0009-0008-0437-6984>

Maciej Jakub Kozicki
Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland.
maciej.kozicki.mk@gmail.com
<https://orcid.org/0009-0000-1966-0306>

Aladdin Salama
Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland.
aladdin1710@gmail.com
<https://orcid.org/0009-0005-2941-1916>

Dominika Domińczak
Medical University of Lodz, 4 Kościuszki Street, 90-419, Lodz, Poland
dominika.dominczak@dtud.umed.lodz.pl
<https://orcid.org/0009-0008-4911-622X>

Shafea Abdulla
Medical University of Warsaw (WUM), 61 Żwirki i Wigury Street, 02-091 Warsaw, Poland
shafea2001@gmail.com
<https://orcid.org/0009-0000-1256-8443>

Abstract

Purpose of research: This literature-based review was created to evaluate the effectiveness of yoga and mindfulness-based interventions (MBIs) in managing chronic and acute cancer-related pain.

Research materials and methods: A systematic review of literature from 2012 - 2026 across databases including PubMed, Scopus, and Web of Science was conducted. Full-text versions of Meta-Analyses, Systematic Reviews, and Randomized Controlled Trials were included.

Basic results: The analysis demonstrates significant reductions in pain interference (how much pain interferes in daily life) and improvements in pain threshold across different groups of patients. Mind-body practices effectively down-regulate pro-inflammatory markers and salivary cortisol. Efficacy was validated in pediatric care, peripheral neuropathy, and through various cognitive-behavioral approaches.

Conclusions: Yoga and mindfulness serve as cost-effective, low-risk non-pharmacological aid that improves the quality of life (QoL) in oncology patients.

Keywords: Oncology, Mindfulness-Based Stress Reduction (MBSR), Hatha Yoga, Chronic Pain, Palliative Care.

Introduction

1. Cancer-Related Pain as a Global Clinical Problem

Cancer incidence remains one of the global health crises, with nearly 20 million new cases and 9.7 million deaths reported annually [3], [11], [15]. Although advancements in early detection and multimodal therapies have significantly increased five-year survival rates to approximately 67%, these survivors often face chronic and debilitating long-term consequences [4], [5], [8]. Cancer-Related Pain (CRP) is defined as a multidimensional experience that transcends physical nociception (the physical sensation of tissue damage) to fundamentally impact the physical, emotional, and spiritual integrity of the patient [1], [4], [16], [31]. Epidemiology reports indicate that CRP is common throughout the cancer continuum, affecting 39% of patients' post-curative treatment, 55% during active therapy, and up to 66% of those with advanced or metastatic disease [2], [7]. Furthermore, persistent pain remains a primary driver of reduced health-related quality of life (HRQoL), often presenting alongside fatigue, anxiety, depression, and severe sleep disturbances [3], [8], [9], [11], [21], [26], [28].

2. The Clinical Gap: Limitations of Conventional Care

The management of CRP presents a significant clinical gap due to the limitations of traditional pharmacological protocols. While opioid-based therapies and non-steroidal anti-inflammatory drugs are the current standard, they often provide only partial relief and carry a high burden of side effects, including chronic constipation, sedation, nausea, and cognitive clouding [5], [7], [15], [26], [28]. The escalating opioid crisis and the risks of long-term dependence further underline the urgent need for non-addictive, multidisciplinary alternatives [1], [5], [7]. Furthermore, standard analgesics fail to address the complex neurophysiological drivers of pain and may even exacerbate treatment-related toxicities, such as balance impairments and sensory loss in survivors of chemotherapy-induced peripheral neuropathy (CIPN) [10], [18], [20], [25], [27], [32].

3. Role of Non-Pharmacological Interventions in Oncology

There is a rapidly increasing interest in integrative oncology, which supports the evidence-based use of complementary practices (such as acupuncture, nutrition and mind-body techniques) alongside medical care (chemotherapy, surgery, and radiation) [12], [13]. This shift is primarily driven by the biopsychosocial model of pain, which recognizes that pain perception is fundamentally modulated by various factors, such as psychological, social and environmental [20]. Patients frequently express a desire for non-pharmacological methods that provide a sense of empowerment, autonomy and motivation to heal [1], [16]. Mind-body therapies (including Hatha yoga, Mindfulness-Based Stress Reduction (MBSR), and meditation) are recommended by international guidelines to treat symptoms of stress, pain, and chronic illness [4], [12], [13], [21].

4. Research Problem and Need for Synthesis

Despite the widespread clinical popularity of these practices, it is still not clear how yoga and mindfulness specifically impact chronic nociceptive and neuropathic pain in cancer populations. While many systematic reviews focus on general mental health or survival outcomes, there is a certain need for an evaluation that focuses on pain interference and threshold modulation [6], [26]. Current literature may offer heterogeneous delivery methods - ranging from traditional in-person classes to online telehealth platforms - and a lack of clarity regarding the optimal "dose" required for significant pain relief [11], [15], [17]. A thorough, evidence-based evaluation is essential to provide clinicians with standardized recommendations for CRP management [14], [22].

Objective of the Review

The primary objective of this review is to evaluate the therapeutic effects of yoga and mindfulness on cancer-related pain using evidence on how these practices modulate the "Pain Matrix", which is a widely distributed network of brain regions, that activates in response to painful stimuli [6], [26]. Furthermore, the review aims to analyze the neurological and physiological mechanisms involved, such as the regulation of the hypothalamic-pituitary-adrenal (HPA) axis and the downregulation of pro-inflammatory markers [3], [19], [24]. This review seeks to demonstrate these mind-body practices as cost-effective (an example how to achieve a desired outcome at the lowest possible cost), low-risk tools

for a more holistic approach to oncology supportive care by evaluating clinical outcomes across diverse populations, including pediatric patients, advanced-stage survivors and those with treatment-induced neuropathy [21], [23], [24].

1. Pathophysiology of Cancer-Related Pain

Clinical Classification of Pain

Cancer-Related Pain (CRP) is categorized based on its underlying causes. Nociceptive pain results from tumor invasion or tissue damage, which triggers the release of inflammatory markers like interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- α) [3], [15]. Neuropathic pain is often more severe and results from nerve damage, specifically Chemotherapy-Induced Peripheral Neuropathy (CIPN) [10], [25], [27]. CIPN typically presents as sensory and motor deficits in a "glove and stocking" pattern (start in the hands and feet and move upwards) [10], [32]. Additionally, treatment-induced pain arises from surgical recovery and radiation. While Enhanced Recovery After Surgery (ERAS) protocols manage acute symptoms, many survivors still face persistent postoperative discomfort [1].

Central Sensitization and Emotional Modulation

Chronic pain can lead to central sensitization, where the nervous system becomes hyper-reactive due to neuroinflammation and changes in the spinal reflex circuit (a rapid, involuntary and stereotyped neural pathway, that produces a response to a stimulus without immediate brain involvement) [10], [15], [25]. This state is often worsened by the Anxiety-Pain-Fatigue Triad, a symptom cluster where psychological distress acts as a "pain amplifier" [26], [31]. Roughly 50% to 70% of cancer patients experience uncontrolled pain that triggers anxiety and depression, which further lowers their pain threshold [26]. In advanced stages, fatigue is often the most disruptive symptom, significantly increasing the perceived intensity of physical pain and reducing overall quality of life [2], [8]. Moreover, psychological stress functions as a trigger for a cascade of physiological responses across the endocrine, nervous, and immune systems, often leading to global immunosuppression [29].

2. Physiological and Psychological Mechanisms of Action

Neuroendocrine and Autonomic Regulation

Mind-body interventions such as yoga and mindfulness restore homeostatic balance by modulating the hypothalamic-pituitary-adrenal (HPA) axis and significantly lowering cortisol levels [4], [6], [24], [32]. Yoga optimizes the body's response to stressful stimuli and inhibits the areas of the limbic system responsible for fear and aggression by inhibiting the sympathetic area of the hypothalamus [29]. This regulation reduces the systemic "allostatic load" (the cumulative impact of chronic stressors on health), which eases chronic stress and pain-related comorbidities [3], [31]. Furthermore, these practices decrease the production of pro-inflammatory cytokines, specifically IL-6, TNF-alpha and IL-12, while simultaneously increasing anti-inflammatory markers such as IL-10, leading to reduced systemic pain sensitivity and improved immune function [4], [17], [19], [29]. Intensive yoga and meditation retreats have been shown to increase plasma levels of Brain-Derived Neurotrophic Factor (BDNF), which supports neuronal survival and the growth of new synapses [29]. At the autonomic level, yoga improves parasympathetic tone by stimulating the Vagus nerve through conscious breathwork (Pranayama), effectively acting as a 'brake' for the body's stress response and allowing the heart and nervous system to return to a state of rest and recovery [4], [10]. This increases Heart Rate Variability (HRV, the precise measure of variation in time between consecutive heartbeats), effectively counteracting the sympathetic "fight-or-flight" response associated with chronic cancer-related pain [4], [5], [24].

Central Pain Modulation and Neuroplasticity

The efficacy of mindfulness is often explained by the Gate Control Theory (neural system in the spinal cord's dorsal horn, that modulates pain signals before they reach the brain), where mindfulness-driven attentional shifts divide sensory pain from emotional distress [3], [5]. This leads to patients' ability to redirect their focus away from pain signals toward neutral sensations, engaging cortical pain-modulation networks by fostering nonreactive awareness [3]. Long-term practice is associated with positive brain plasticity, including increased gray matter density in the anterior cingulate cortex (ACC) and the

prefrontal cortex, which are critical for emotional regulation [4], [6], [17]. Additionally, these interventions promote reduced catastrophizing through cognitive reframing (psychological technique used to identify, challenge and replace negative or irrational thoughts with more balanced, realistic and constructive perspectives), empowering patients to reconceptualize pain as a manageable experience rather than an unavoidable source of suffering [20], [31].

3. Yoga as a Multi-Modal Contributor to Health Quality

Musculoskeletal and Functional Effects

Yoga postures (asanas) provide a reliable method to enhance strength, balance, and flexibility in oncology patients [10]. These practices improve lymphatic drainage and alleviate muscle tension, which is particularly helpful for recovery following invasive breast procedures [1], [22]. To support patients with severe fatigue or advanced disease, styles such as Restorative or Iyengar yoga can be modified using props like blocks and blankets to ensure safety [2], [6], [13], [5]. Furthermore, low-impact protocols like Yoga-Nidra and somatic movements offer non-invasive ways to maintain physical and cognitive function without over-exertion [3], [10]. Beyond its physical impact, yoga serves as a means of behavioral activation, the satisfaction derived from the practice enhances resilience and helps patients manage the emotional weight of their diagnosis [30].

Clinical Evidence from Randomized Controlled Trials (RCTs)

RCTs confirm that yoga reduces side effects like nausea and fatigue during chemotherapy and radiation [3], [13], [16], [19], [21], [23], [24], [28]. These practices lead to long-term pain relief and improved quality of life in cancer survivors by addressing "symptom clusters" involving chronic pain and sleep disturbance [6], [9], [18], [20], [32]. Compliance is critical - practicing yoga on two consecutive days is a strong predictor of lower pain levels the following day [5]. Recent meta-analyses also identify an inverted U-shaped relationship between practice volume and relief (outcome - relief - improves as a factor - volume - increases up to an optimal point but worsens if the factor continues to increase beyond that point), suggesting that the most favorable therapeutic dose is approximately 780 MET-min/week [15]. A Metabolic Equivalent of Task (MET) is a way to measure how much energy the body uses during a specific activity compared to sitting quietly (for example resting = 1 MET, Hatha Yoga = 2.5 to 3 METs, Power/Vinyasa Yoga = 4 METs).

4. Mindfulness-Based Interventions (MBIs) in Oncology

Structure and Efficacy of Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT) typically suggest a standardized 8-week model that has proven effective in reducing the intensity and interference of cancer-related pain [4], [13], [26], [31]. The avoidance of internal negative experiences often leads to psychological inflexibility (a state where yoga can intervene by fostering a sense of being here and now and deepening sensory awareness) [30]. These structured programs teach patients to maintain non-judgmental, moment-to-moment awareness, which is vital for managing the psychological and physical burden of chronic illness [4], [30], [31]. The core aim of practicing mindfulness is to help patients become more reflective and resistant to internal 'unpleasantness,' which is thought to be highly beneficial for psychological health [29]. Consequently, the therapeutic impact is largely driven by psychological mediators, such as improved emotional regulation, the acceptance of pain as a transient state, and a significant decrease in catastrophic thinking or rumination (overthinking, reflection) regarding the disease [7], [26], [31].

Comparative and Combined Effects

A powerful synergy is observed when yoga is integrated with mindfulness, as these combined programs lead to multidimensional improvements in sleep quality, fatigue, and pain perception [4], [10], [17], [19], [29]. These integrated therapies are consistently more effective than standard care for managing complex symptom clusters [17], [24]. Furthermore, innovative approaches like pairing Pain Neuroscience Education (PNE) with therapeutic yoga in Graded Exposure to Movement through Therapeutic Yoga (GEM-Y) provide superior long-term results for pain self-efficacy compared to traditional physical therapy [20]. Modern delivery methods, including online and paired (patient-caregiver) programs, have

successfully increased accessibility for underserved populations by removing transportation and geographical barriers [11], [27], [31].

5. Quality of Life (QoL) and Psychological Drivers

Sleep Quality and the Circadian Interaction Insomnia affect approximately 40% of oncology patients and serve to worsen pain perception [4]. Research identifies a strong link between mindfulness-improved sleep and reduced pain the following day [5]. High sleep efficiency is further associated with improved heart rate variability and longer survival in metastatic cases [4]. Online yoga has proven effective in reducing sleep latency and daytime dysfunction, enabling nearly 20% of participants to reach normal sleep scores [11]. Similarly, laughter yoga has demonstrated significant improvements in subjective sleep quality for patients with hematologic malignancies [28].

Addressing the "Pain-Depression-Fatigue" Triad

Psychological distress acts as a "pain amplifier" within the common "Pain-Depression-Fatigue" triad, which can inhibit treatment adherence [8], [9], [26]. Mindfulness-based interventions address this cluster by stabilizing neurotransmitters, such as serotonin and noradrenaline, which influence pain thresholds [26]. While yoga provides psychological relief during chemotherapy, its impact is often more significant for anxiety and depression than for physical pain intensity [19], [32]. Research suggests that yoga may have a superior antidepressant effect compared to pharmacological treatments alone, particularly in reducing symptoms of anger and neuroticism [29]. In oral oncology, yoga has been shown to lower anxiety while enhancing both cognitive and emotional functioning [16]. Regular yoga practice has been linked to a significant increase in cognitive functions including concentration, memory, and attentiveness, especially among seniors, helping to preserve independence and quality of life [30].

6. Safety, Contraindications, and Implementation in Oncology

Safety Profile and Adaptations

Yoga and mindfulness are safe for oncology patients, with very low rates of adverse events [6], [18], [30]. Most reported issues, such as minor muscle strain, are easily managed by adapting physical poses [2], [6]. Yoga and balance training can reduce the involuntary contraction of antagonist muscles, effectively shortening the latency of muscle activation and increasing reflex activity [30]. Low-impact techniques like somatic movement and Yoga-Nidra are especially useful for patients with limited mobility because they activate the relaxation response without physical exertion [3], [10]. These interventions are also suitable and beneficial for pediatric patients and their caregivers [23].

Contraindications and Personalized Modifications

Practices must be modified based on a patient's specific clinical condition. For instance, weight-bearing poses (that require placing the body weight onto a limb) are contraindicated for those with bone metastases to avoid fractures [2]. Patients facing severe fatigue, heart instability, or chemotherapy-induced peripheral neuropathy (CIPN) require specialized protocols, such as restorative or chair yoga, to ensure comfort [3], [10], [27]. Therapists should also monitor survivors with low immunity or brittle bones and carefully supervise movement in CIPN cases to manage sensory loss and balance issues [3], [25], [27].

Implementation in Clinical Practice

Integrating yoga into hospital departments is now recognized as a standard supportive care practice [12], [13]. Effective delivery relies on certified instructors with oncology training who can tailor programs to the patient's cancer type and treatment stage [1], [13]. Additionally, telehealth options have improved accessibility for rural populations, maintaining high satisfaction while reducing travel-related barriers [11], [18], [21], [31]. Standard guidelines suggest that a multidisciplinary approach is necessary to establish these tools as core parts of cancer rehabilitation [14], [15], [20], [24].

7. Methodological Considerations and Limitations of Current Research

Small Sample Sizes

Many studies are limited by small sample sizes, which reduce statistical power and make it difficult to generalize findings [1], [32]. This is especially common in research involving advanced-stage cancer, where disease progression and high patient burden interfere with recruitment and retention [2], [3]. Consequently, many pilot trials remain descriptive rather than providing definitive evidence of efficacy [18], [21].

Heterogeneity of Interventions

There is a significant lack of standardization in mind-body protocols, with wide variations in yoga styles, session frequency, and delivery formats—ranging from in-person classes to online modules [11], [13]. Additionally, the differing proficiency of instructors can impact the quality and safety of the intervention [1], [8]. This heterogeneity makes it challenging for researchers to identify the most effective "dose" or specific techniques for pain relief [15], [24].

Variability in Pain Measurement Tools

Research relies heavily on subjective self-reported measures, such as the Visual Analogue Scale (VAS) or Brief Pain Inventory (BPI), which are susceptible to recall bias [7], [15]. There is a notable absence of objective biomarkers, such as inflammatory cytokine levels or neuroimaging, to validate these reports [8], [19]. Furthermore, the use of diverse measurement scales across studies complicates quantitative meta-analysis and often fails to distinguish between different types of pain, such as nociceptive and neuropathic [7], [25].

Lack of Long-Term Follow-Up

A critical gap exists regarding the durability of treatment effects, as most interventions last only 8 to 12 weeks [3], [6]. While acute improvements in pain and anxiety are frequently reported, these benefits may decline once the structured program ends [7], [10]. Longitudinal data are necessary to determine if continuous practice can provide lasting relief for chronic conditions like chemotherapy-induced peripheral neuropathy (CIPN) during long-term survivorship [27], [32].

Research materials and methods

1. Study Design and Scope

This literature-based review aims to analyze current evidence regarding the effectiveness and safety of yoga and mindfulness-based interventions in the management of cancer-related pain (CRP) [7]. To ensure the information is both transparent and trustworthy, the methodology followed the principles used in systematic reviews, focusing on high-quality randomized controlled trials (RCTs), large-scale meta-analyses and systemic reviews [6], [8], [26]. The research includes experiences of diverse oncological populations, including those in active treatment, survivors, and patients in palliative care [2], [3], [21].

2. Literature Search Strategy

The search strategy was directed by identifying relevant publications from major scientific databases specific to biomedical and sports science research, including PubMed/MEDLINE, Scopus, Web of Science, EMBASE, and the Cochrane Central Register of Controlled Trials (CENTRAL) [6], [7], [11], [27]. The search window covered records from the inception of these databases through 2026, ensuring the inclusion of both foundational research and new clinical breakthroughs [15], [24]. The final verification of search results was completed in February 2026.

Among the keywords used to find the most relevant articles were: "cancer-related pain", "oncology", "Hatha yoga", "Mindfulness-Based Stress Reduction", "MBSR", "MBCT", "chronic pain", "palliative care", and "integrative oncology" [4], [13], [26], [31].

3. Study Selection Criteria (PICOS Framework)

The selection process depended on specific inclusion criteria to guarantee the focus on the highest quality of evidence.

Criterion	Specification	Justification
P (Population)	Adult oncology patients (18+)	To evaluate effects across all stages (I-IV) and different stages and age survivors [2], [4], [16]. The populations [7].
I (Intervention)	Yoga (Hatha, Iyengar, Laughter, Nidra) and Mindfulness (MBSR, MBCT)	Focus on standardized mind-body protocols [6], [28], [32].
C (Comparison)	Usual care, waitlist controls,	To determine additive social support, or conventional therapeutic value [17], [26].
O (Outcomes)	Pain intensity (VAS/NRS), pain interference (BPI), QoL, and biological markers (Cortisol)	Multidimensional assessment of clinical efficacy [14], [25]. [5], [24].
S (Study Design)	Limited to high-level evidence: Meta-Analysis, Systematic Review (SR), or Randomized Controlled Trial (RCT)	To ensure validity and reliability of the evidence base [7], [9]. [15], [22].

4. Data Extraction and Synthesis

From the selected literature, the following types of information were systematically extracted and synthesized:

1. Study Characteristics: Author, year, design, and specific population types, including pediatric survivors [23], breast cancer cohorts [6], and head and neck cancer patients [21].
2. Intervention Protocols: Specific modalities such as online delivery [11], [31], dose-response relationships [15], and therapist-guided vs. self-guided practice [18].
3. Performance and Pain Outcomes: Reductions in neuropathic pain [25], [32], functional mobility/fall risk [10], [18], and pain self-efficacy [20].
4. Biochemical and Psychological Markers: Changes in salivary cortisol [17], inflammatory cytokines [19], and anxiety/depression clusters [19], [28], [29].
5. Safety and Feasibility: Monitoring of adverse events such as localized muscle strain and evaluation of intervention adherence in fragile populations [2], [3], [18], [23], [30].
6. The synthesis of these sources [2], [13], [22] allowed for a comprehensive qualitative discussion supported by quantitative data (Standardized Mean Differences) reported in the included meta-analyses [9], [15], [25], [26]. The high methodological quality of the included studies provides a solid basis for evidence-based conclusions regarding integrative oncology.

Results

1. Physiological Mechanisms and Neuroendocrine Regulation

The primary therapeutic mechanism of yoga and mindfulness-based interventions (MBIs) in managing cancer-related pain (CRP) is the capacity to restore homeostatic balance to the central nervous system [4], [6], [7], [26]. Mind-body exercises such as Tai Chi, Yoga, and Qigong promote neuroplastic changes by stimulating brain tissue, increasing cerebral blood flow, and activating neuroendocrine pathways, which collectively improve motor function and perception [30].

HPA Axis Modulation: These practices consistently downregulate the hypothalamic-pituitary-adrenal (HPA) axis, leading to a significant reduction in salivary cortisol levels [6], [17], [24]. This reduction mitigates the systemic "allostatic load" associated with chronic stress and pain hypersensitivity [3], [31].

Inflammatory Cytokines: Mind-body interventions influence the production of pro-inflammatory markers, specifically reducing levels of IL-6, TNF-alpha and IL-12, which are known drivers of tissue-damage pain and central sensitization [3], [17], [19], [29].

Parasympathetic Activation: Conscious breathwork (pranayama) stimulates the Vagus nerve, increasing Heart Rate Variability (HRV) and shifting the autonomic nervous system from a sympathetic "fight-or-flight" state to a parasympathetic relaxation response [4], [10], [24].

Neurochemical Shifts: Imaging studies suggest that yoga increases endogenous release of dopamine, serotonin and elevates thalamic levels of gamma-aminobutyric acid (GABA), both of which are critical for the pathophysiology of psychological distress and pain modulation [6], [30].

2. Impact on Pain Outcomes by Cancer Stage and Treatment Phase

The efficacy of mind-body interventions is influenced by the patient's clinical status and the specific modality of practice.

Active Treatment Phase (Chemotherapy and Radiation): Yoga and mindfulness effectively soften acute treatment-related side effects. Studies report significant reductions in nausea, vomiting, and head and neck pain during radiotherapy and chemotherapy cycles [11], [16], [21], [24], [28].

Post-Treatment and Survivorship: For cancer survivors, these interventions address persistent nociceptive and neuropathic pain [6], [15], [32].

Neuropathic Pain (CIPN): Somatic yoga and meditation have shown preliminary efficacy in reducing the intensity of Chemotherapy-Induced Peripheral Neuropathy (CIPN), improving sensory function, balance, and reducing fall risk [10], [18], [25], [27], [32].

Dose-Response Relationship: A Bayesian network meta-analysis revealed an inverted U-shaped relationship between exercise dose and pain relief, with an optimal dose of approximately 780 MET-min/week [15]. Furthermore, practicing yoga on two consecutive days is highly predictive of lower pain levels on the following day [5].

3. Impact on Quality of Life (QoL) and Symptom Clusters

Yoga and mindfulness address the multidimensional nature of pain by targeting co-occurring symptoms. **Sleep Quality:** Improved sleep efficiency via mindfulness is strongly correlated with reduced pain perception the next day [4], [5]. Online yoga has shifted nearly 20% of participants from clinically significant sleep disturbance to normal sleep scores [11], [28].

Anxiety and Depression: Mindfulness yoga is superior to conventional care in managing the "Pain-Depression-Fatigue" triad, alleviating psychological distress and increasing emotional functioning [3], [16], [19], [26].

Self-Efficacy and Acceptance: Integrating Pain Neuroscience Education (PNE) with therapeutic yoga (GEM-Y) significantly improves pain self-efficacy and reduces catastrophizing compared to usual care [20].

4. Intervention Protocols and Safety

Standardized Models: The 8-to-9-week model of Mindfulness-Based Cancer Recovery (MBCR) and MBSR remains the gold standard, showing robust results in reducing pain interference [4], [31].

Remote Delivery: Online yoga and telehealth interventions are achievable and effective, addressing transportation barriers and increasing accessibility for rural populations while maintaining high participant satisfaction [11], [18], [21], [31].

Safety Profile: Yoga and mindfulness are characterized by a low adverse event rate [6], [18]. Minor effects such as transient dizziness or muscle strain are easily managed through adaptations for advanced cancer, such as restorative yoga or Yoga-Nidra for those with limited mobility [2], [3], [23]. Yoga and balance training can reduce the involuntary contraction of antagonist muscles, effectively shortening the latency of muscle activation and increasing reflex activity [30].

5. Secondary and Population-Specific Effects

Pediatric Care: Mind-body therapies are safe and effective in alleviating pain and anxiety for children and adolescents undergoing active treatment [23].

Advanced and Metastatic Cancer: Yoga-Nidra and guided imagery provide significant short-term symptom relief for patients in palliative care, although long-term differences are less detectable [3], [14].

Comparison to Other Methods: While guided imagery and music therapy show promise for acute post-operative pain, yoga and MBSR provide more multidimensional improvements in long-term health-related quality of life [1], [8], [9], [12], [13], [22].

Discussion

1. Interpretation of Findings and Strength of Evidence

The synthesis of current literature reveals that mind-body therapies (MBTs), specifically yoga and mindfulness, exert a significant therapeutic effect on cancer-related pain (CRP) with an average standardized mean difference of -0.39 [7]. The strength of evidence is particularly robust regarding the management of common symptom clusters, showing positive outcome ratios of 73.9% for sleep quality and 68.4% for fatigue [17]. High-quality Cochrane reviews further validate that yoga serves as a critical supportive therapy for improving health-related quality of life (HRQoL) and mental health in breast cancer cohorts [6]. While statistical significance is frequently achieved in within-group analyses for pain intensity and sensory interference, researchers distinguish this from clinical significance; for instance, while interventions may significantly reduce anxiety and depression by week 12, the direct reduction of physical pain intensity sometimes presents more modest between-group differences [6], [32].

2. Biopsychosocial Integration: Targeting Multiple Pain Dimensions

Yoga and mindfulness are uniquely positioned as "biopsychosocial" interventions that address the physical, emotional, and spiritual dimensions of CRP [20].

By integrating physical postures (asanas), conscious breathing (pranayama), and meditation (dhyana), these practices modulate the "Pain Matrix" through the activation of the parasympathetic nervous system and the downregulation of the hypothalamic-pituitary-adrenal (HPA) axis [4], [24]. Techniques such as Yoga-Nidra and guided imagery facilitate "cognitive reframing," allowing patients to decouple the sensory aspect of pain from emotional distress [3], [5]. This multidimensional approach is essential for addressing the "Pain-Depression-Fatigue" triad, where psychological distress acts as a physiological pain amplifier [8], [9], [26].

3. Yoga vs. Conventional Physical Therapy and Pharmacological Treatment

Comparative analyses suggest that yoga may offer superior psychological benefits and higher adherence rates compared to conventional physical therapy due to its focus on mindfulness and self-compassion [1], [20]. While traditional exercise modalities like walking and resistance training effectively improve shoulder mobility and reduce lymphedema, they can occasionally exacerbate fatigue if not properly dosed [1], [22]. In contrast, restorative and somatic yoga protocols provide a low-risk, adaptable alternative for patients with metastatic disease or severe treatment-induced toxicities [2], [6], [10]. When compared to pharmacological management, MBTs offer a non-addictive, complementary approach that avoids the secondary burden of opioid-related side effects such as sedation and chronic constipation [5], [7].

4. The Dose-Response Relationship

Evidence indicates that the frequency of practice correlates significantly with pain reduction, though the relationship may not be strictly linear [15]. Longitudinal diary studies show that practicing yoga on two consecutive days is a strong predictor of lower pain levels on the following day [5]. Network meta-analyses suggest an inverted U-shaped relationship between exercise volume and relief, identifying an optimal therapeutic dose of approximately 780 MET-min/week for cancer survivors [15]. Furthermore, combined programs featuring 170 minutes of aerobic and resistance training per week appear most effective for systemic pain alleviation [15].

5. Critical Analysis: The "Placebo Effect" and Standardized Protocols

A major challenge in mind-body research is the difficulty of blinding participants and staff, which increases the risk of performance bias and the placebo effect [1], [7]. While these effects may contribute to pain control through natural neurotransmitter systems, there is a clear need for larger randomized controlled trials (RCTs) with standardized protocols to identify the specific "active ingredients" of these therapies [1], [7], [14]. Furthermore, many alternative or bioenergy therapies currently show significant effects only in studies with lower methodological quality, necessitating more rigorous evidence-based validation [14].

6. Implications for Sports and Health Sciences: Movement as Medicine

The integration of yoga and mindfulness into oncology represents a shift toward "movement as medicine," where physical activity is used to enhance the functional health and quality of life of survivors [15], [22].

These practices are safe and feasible across the entire cancer continuum, including pediatric oncology and advanced palliative care [2], [3], [23]. Emerging delivery formats, such as telehealth and online

yoga, have successfully improved access for underserved and rural populations by removing transportation and logistical barriers [11], [18], [31]. Ultimately, these mind-body tools empower patients to take an active role in their own recovery, fostering long-term resilience and physical competence [1], [16].

Practical Recommendations

The evidence synthesized from the provided literature allows for the formulation of practical clinical recommendations for the integration of yoga and mindfulness into standard oncology care [1], [4], [13]. Standardized protocols suggest a recommended session duration of 45 to 60 minutes, which provides sufficient therapeutic exposure while remaining within the physical tolerance levels of patients undergoing intensive treatments [18], [21], [28]. For the optimal management of chronic nociceptive and neuropathic pain, a frequency of 2 to 3 sessions per week is advised, as longitudinal diary data indicate that consistent practice on consecutive days is a strong predictor of reduced pain perception on the following day [5], [6], [21].

For individuals identified as frail patients, those with advanced metastatic disease, or those experiencing severe treatment-induced toxicities, the use of gentle and restorative yoga is cardinal; these sessions should utilize specialized props such as bolsters, blocks, and blankets to ensure physical safety and prevent pathological fractures [2], [3], [5], [10], [13].

Modalities like Yoga-Nidra and guided relaxation are particularly suitable for patients with limited mobility or extreme fatigue, as they activate the parasympathetic nervous system through focused awareness rather than strenuous physical exertion [3], [10]. Furthermore, structured mindfulness training, including body scans and nonreactive meditation, is essential for emotional pain modulation, as it facilitates the "de-coupling" of sensory nociception from psychological distress and rumination [3], [7], [31].

Successful clinical implementation requires a multidisciplinary collaboration involving the primary oncologist, physiotherapist, and psychologist to ensure that the mind-body program aligns with the patient's clinical status and functional goals [1], [13], [24]. All interventions should be led by certified instructors with specialized training in oncology to monitor for specific contraindications and to adapt protocols for treatment-induced outcomes like peripheral neuropathy [10], [13], [32]. Additionally, healthcare providers should leverage telehealth and online delivery formats to increase accessibility and satisfaction for underserved or rural populations [11], [18], [31]. Finally, practitioners are encouraged to incorporate conscious breathwork (pranayama) and innovative tools such as laughter yoga to target the common "symptom cluster" of sleep disturbances and reduced quality of life [4], [15], [24], [28].

Conclusions

Mind-body interventions (MBIs), including Hatha yoga and mindfulness-based stress reduction, demonstrate significant therapeutic effectiveness in reducing both the intensity and interference of cancer-related pain [7], [26], [32]. Beyond direct analgesic effects, these practices alleviate the broader symptom cluster of fatigue, anxiety, depression, and sleep disturbance, which fundamentally drive the patient's pain experience [3], [4], [24], [28]. The neurophysiological mechanisms supporting pain reduction are multifaceted, involving the regulation of the hypothalamic-pituitary-adrenal (HPA) axis, the lowering of salivary cortisol, and the downregulation of pro-inflammatory cytokines that contribute to central sensitization [6], [17], [19]. Somatic movement and breathwork further improve heart rate variability and parasympathetic tone, empowering patients to decouple sensory nociception from emotional suffering [5], [10].

The clinical applicability of yoga and mindfulness is remarkably high, as these practices are established as cost-effective, low-risk tools suitable for patients ranging from pediatric cohorts to those in advanced palliative care [1], [2], [23]. Current clinical guidelines identify yoga as a high-level supportive care option for improving mood and quality of life during active chemotherapy and radiation [12], [13]. Advances in telehealth delivery and online program adaptations have further increased the reach and feasibility of these interventions for underserved survivors by mitigating logistical barriers such as transportation and treatment-related fatigue [11], [18], [31]. Furthermore, the integration of Pain Neuroscience Education (PNE) with movement provides a superior longitudinal framework for enhancing pain self-efficacy and functional independence [20], [27].

Despite these clear benefits, there is a pronounced need for larger randomized controlled trials (RCTs) that utilize standardized protocols to clarify the optimal dose-response relationship and the long-term

sustainability of treatment effects [9], [14], [15]. Current literature is often limited by small sample sizes and high variability in measurement tools, necessitating more rigorous synthesis and the use of objective biomarkers [22], [25]. A final recommendation for integration into oncology care is for clinicians to move beyond a purely pharmacological paradigm and include yoga and mindfulness in multidisciplinary cancer care plans [8], [16], [21]. By adopting these integrative mind-body tools, healthcare providers can offer a truly holistic approach that restores functional integrity and enhances the overall quality of life for cancer survivors.

Summary

In conclusion, yoga and mindfulness-based interventions are scientifically supported strategies for oncology patients seeking to alleviate cancer-related pain and associated symptom clusters [1], [7], [8], [26]. Their efficacy is maximized through standardized 8-to-12-week protocols and consistent practice—especially on consecutive days—to regulate the HPA axis, lower cortisol levels, and reduce pro-inflammatory cytokines [4], [5], [6], [17], [19], [24].

The consistent findings regarding decreased pain interference, enhanced sleep quality, and improved functional mobility underscore these therapies' value as safe, cost-effective tools across the entire cancer continuum, from pediatric care to advanced palliative settings [3], [11], [12], [13], [16], [23], [28]. Future research should focus on optimizing standardized delivery methods such as telehealth and dyadic programs and further clarifying the neuroprotective role of mind-body movement in managing chronic treatment toxicities like peripheral neuropathy and restoring global quality of life [2], [9], [10], [14], [15], [18], [20], [21], [22], [25], [27], [31], [32].

Disclosure

Author's contribution

Conceptualization: Tetiana Savchak, Sofiia Ivanchuk and Anhelina Kaminskaya

Methodology: Aleksandra Kurek and Aleksandra Głowacka

Investigation: Aladdin Salama, Shafea Abdulla and Hubert Feretycki

Data curation: Patryk Górecki, Maciej Kozicki and Dominika Domińczak

Formal analysis: Patryk Górecki, Aleksandra Kurek and Aleksandra Głowacka

Visualization: Aleksandra Kurek and Aleksandra Głowacka

Writing – original draft: Tetiana Savchak, Sofiia Ivanchuk and Anhelina Kaminskaya

Writing – review and editing: Hubert Feretycki, Aladdin Salama and Shafea Abdulla

Supervision: Tetiana Savchak, Maciej Kozicki and Dominika Domińczak

All authors have read and agreed with the published version of the manuscript.

Funding Statement

The study did not receive special funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

Not applicable.

Conflict of Interest Statement

The authors declare no conflicts of interest.

Acknowledgements

Not applicable.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process. During the preparation of this article, the authors used ChatGPT and Google Gemini to refine the work's grammar and improve overall readability. Following the application of this service, the authors thoroughly reviewed and edited the generated suggestions. The authors assume full responsibility for the integrity, accuracy, and original contributions of the final published content.

References:

1. Abushukur Y, Cascardo C, Ibrahim Y, Teklehaimanot F, Knackstedt R (2022). Improving Breast Surgery Outcomes Through Alternative Therapy: A Systematic Review. *Cureus*, 2022, 24;14(3):e23443, <https://doi.org/10.7759/cureus.23443>.
2. Albrecht TA, Taylor AG (2012). Physical activity in patients with advanced-stage cancer: a systematic review of the literature. *Clin J Oncol Nurs*, 2012, 16(3):293-300, <https://doi.org/10.1188/12.cjon.293-300>.
3. Baruah M, Poovamma CU, Narayanan P, Harish P, Keshav R, Babu N, Pandey M (2026). Yoga-Nidra as a complementary therapy for reducing psychological distress and enhancing quality of life in cancer patients: A randomized controlled trial. *Elsevier* ,2025, 103313, <https://doi.org/10.1016/j.ctim.2025.103313>.
4. Carlson LE, Zelinski EL, Speca M, Balneaves LG, Jones JM, Mina DS, Wayne PM, Campbell TS, Giese-Davis J, Faris P, Zwicker J, Patel K, Beattie TL, Cole S, Toivonen K, Nation J, Peng P, Thong B, Wong R, Vohra S (2018). Protocol for the Cancer Health: MATCH Study: Mindfulness And Tai Chi for A Preference-Based Multi-Site Randomized Comparative Effectiveness Trial (CET) of Mindfulness-Based Cancer Recovery (MBCR) vs. Tai Chi/Qigong (TCQ) for Cancer Survivors. *Contemp Clin Trials*, 2017, 30;59:64–76, <https://doi.org/10.1016/j.cct.2017.05.015>.
5. Carson JW, Carson KM, Olsen M, Sanders L, Westbrook K, Keefe FJ, Porter LS (2021). Yoga Practice Predicts Improvements in Day-to-Day Pain in Women With Metastatic Breast Cancer. *J Pain Symptom Manage*, 2021, 61(6):1227-1233, <https://doi.org/10.1016/j.jpainsymman.2020.10.009>.
6. Cramer H, Lauche R, Klose P, Lange S, Langhorst J, Dobos GJ (2017). Yoga for improving health-related quality of life, mental health and cancer-related symptoms in women diagnosed with breast cancer. *Cochrane Database Syst Rev*, 2017, 3;1(1):CD010802, <https://doi.org/10.1002/14651858.cd010802.pub2>.
7. Danon N, Al-Gobari M, Burnand B, Rodondi PY (2022). Are mind-body therapies effective for relieving cancer-related pain in adults? A systematic review and meta-analysis. *Psychooncology*, 2021, 21;31(3):345–371, <https://doi.org/10.1002/pon.5821>.
8. Di Mattei VE, Perego G, Milano F, Gatti F (2024). The Effectiveness of Nonpharmacological Interventions in the Management of Chemotherapy Physical Side Effects: A Systematic Review. *Healthcare (Basel)*, 2024, 19;12(18):1880, <https://doi.org/10.3390/healthcare12181880>.
9. Dong J, Wang D, Zhong S (2024). Effects of different exercise types and cycles on pain and quality of life in breast cancer patients: A systematic review and network meta-analysis. *PLoS One*, 2024, 19(7):e0300176, <https://doi.org/10.1371/journal.pone.0300176>.
10. Galantino ML, Tiger R, Brooks J, Jang S, Wilson K (2019). Impact of Somatic Yoga and Meditation on Fall Risk, Function, and Quality of Life for Chemotherapy-Induced Peripheral Neuropathy Syndrome in Cancer Survivors. *Integr Cancer Ther*, 2019, 25;18:1534735419850627, <https://doi.org/10.1177/1534735419850627>.
11. Gatti F, Perego G, Milano F, Calleri G, Giurioli B, Di Mattei VE (2025). The Effects of Online Yoga Practice on Cancer Patients: A Systematic Review. *Healthcare (Basel)*, 2025, 23;13(3):225, <https://doi.org/10.3390/healthcare13030225>.
12. Greenlee H, Balneaves LG, Carlson LE, Cohen M, Deng G, Hershman D, Mumber M, Perlmutter J, Seely D, Sen A, Zick SM, Tripathy D (2014). Clinical practice guidelines on the use of

- integrative therapies as supportive care in patients treated for breast cancer. *J Natl Cancer Inst Monogr*, 2014, 4;2014(50):346–358, <https://doi.org/10.1093/jncimonographs/lgu041>.
13. Greenlee H, DuPont-Reyes M, Balneaves LG, Carlson LE, Cohen MR, Deng G, Johnson JA, Mumber M, Seely D, Zick SM, Boyce LM, Tripathy D (2017). Clinical practice guidelines on the evidence-based use of integrative therapies during and after breast cancer treatment. *CA Cancer J Clin*, 2017, 6;67(3):194-232, <https://doi.org/10.3322/caac.21397>.
 14. Hauptmann M, Kutschan S, Hübner J, Dörfler J (2023). Bioenergy therapies as a complementary treatment: a systematic review to evaluate the efficacy of bioenergy therapies in relieving treatment toxicities in patients with cancer. *J Cancer Res Clin Oncol*, 2022, 27;149(6):2607–2619, <https://doi.org/10.1007/s00432-022-04362-x>.
 15. Huang H, Chen X, Wang Z, Zhang Y (2026). Evidence-based prescription: optimal exercise type and dose for pain management in breast cancer survivors—a systematic review and dose–response network meta-analysis. *BMC Cancer*, 2025, 6;26:59, <https://doi.org/10.1186/s12885-025-15432-x>.
 16. Kanmodi KK, Braimah RO, Amzat J, Salami AA, Nnyanzi LA (2023). Applications of yoga in oral oncology: A systematic scoping review. *Health Sci Rep*, 2023, 11;6(4):e1208, <https://doi.org/10.1002/hsr2.1208>.
 17. Kim DY, Hong SH, Jang SH, Park SH, Noh JH, Seok JM, Jo HJ, Son CG, Lee EJ (2022). Systematic Review for the Medical Applications of Meditation in Randomized Controlled Trials. *Int J Environ Res Public Health* 2022, 22;19(3):1244, <https://doi.org/10.3390/ijerph19031244>.
 18. Knoerl R, Giobbie-Hurder A, Berfield J, Berry D, Meyerhardt JA, Wright AA, Ligibel JA (2021). Yoga for chronic chemotherapy-induced peripheral neuropathy pain: a pilot, randomized controlled trial. *J Cancer Surviv*, 2021, 15;16(4):882–891, <https://doi.org/10.1007/s11764-021-01081-z>.
 19. Liu W, Liu J, Ma L, Chen J (2022). Effect of mindfulness yoga on anxiety and depression in early breast cancer patients received adjuvant chemotherapy: a randomized clinical trial. *J Cancer Res Clin Oncol*, 2022, 148(9):2549-2560, <https://doi.org/10.1007/s00432-022-04167-y>.
 20. Martínez-Miranda P, Jiménez-Rejano JJ, Muñoz-Fernández MJ, García-Muñoz C, Casuso-Holgado MJ (2024). Effectiveness of an interactive online group intervention based on pain neuroscience education and graded exposure to movement in breast cancer survivors with chronic pain: a randomised controlled trial. *Support Care Cancer*, 2024, 32(10):705, <https://doi.org/10.1007/s00520-024-08887-4>.
 21. Milbury K, Rosenthal DI, Li Y, Ngo-Huang AT, Mallaiiah S, Yousuf S, Fuller CD, Lewis C, Bruera E, Cohn L (2024). Dyadic Yoga for Head and Neck Cancer Patients Undergoing Chemoradiation and their Family Caregivers. *J Pain Symptom Manage*, 2024, 5;67(6):490–500, <https://doi.org/10.1016/j.jpainsymman.2024.02.565>.
 22. Möller UO, Beck I, Rydén L, Malmström M (2019). A comprehensive approach to rehabilitation interventions following breast cancer treatment - a systematic review of systematic reviews. *BMC Cancer*, 2019, 20;19(1):472, <https://doi.org/10.1186/s12885-019-5648-7>.
 23. Mora DC, Kristoffersen AE, Overvåg G, Jong MC, Mentink M, Liu J, Stub T (2022). Safety of Complementary and Alternative Medicine (CAM) treatment among children and young adults who suffer from adverse effects of conventional cancer treatment: A systematic review. *Integr Cancer Ther*, 2022, 21;21:15347354221105563, <https://doi.org/10.1177/15347354221105563>.
 24. Namazinia M, Mazlum SR, Mohajer S, Lopez V (2023). Effects of laughter yoga on health-related quality of life in cancer patients undergoing chemotherapy: a randomized clinical trial. *BMC Complement Med Ther*, 2023, 12;23:192, <https://doi.org/10.1186/s12906-023-04028-2>.
 25. Papadopoulou M, Stamou M, Bakalidou D, Moschovos C, Zouvelou V, Zis P, Tzartos J, Chroni E, Michopoulos I, Tsigoulis G (2023). Non-pharmacological Interventions on Pain and Quality of Life in Chemotherapy Induced Polyneuropathy: Systematic Review and Meta-Analysis. *In Vivo*, 2023, 37(1):47-56, <https://doi.org/10.21873/invivo.13053>.
 26. Ruano A, García-Torres F, Galvez-Lara M, Moriana JA (2022). Psychological and Non-Pharmacologic Treatments for Pain in Cancer Patients: A Systematic Review and Meta-Analysis. *J Pain Symptom Manage*, 2022, 63(5):e505-e520, <https://doi.org/10.1016/j.jpainsymman.2021.12.021>.

27. Tamayo Fajardo JA, Parejo LP (2025). Effectiveness of Exercise and Physiotherapy in Chemotherapy-Induced Peripheral Neuropathy: A Systematic Review. *Healthcare (Basel)*, 2025, 19;13(22):2973, <https://doi.org/10.3390/healthcare13222973>.
28. Ugur O, Bedez G, Zeybekci S, Karadag E (2025). The Effect of Laughter Yoga on Chemotherapy-Induced Symptoms and Sleep Quality in Patients with Haematologic Cancer. *Asian Pac J Cancer Prev*, 2025, 26(6):1959–1970, <https://doi.org/10.31557/APJCP.2025.26.6.1959>.
29. Wójcik M, Boreński G, Poleszak J, Szabat P, Szabat M, Milanowska J (2019). Meditation and its benefits. *Journal of Education, Health and Sport*, 2019, 9(9):466-476, eISSN 2391-8306, <http://dx.doi.org/10.5281/zenodo.3408542>.
30. Zadrożna K, Wysokińska O, Żyga J, Małek A, Fabiś M, Wójcik B, Iwaniszyn-Zapołoch K (2022). Effects of regular yoga practice on neurological conditions and mental health. *Journal of Education, Health and Sport*, 2022, 12(12):35-41. eISSN 2391-8306, <http://dx.doi.org/10.12775/JEHS.2022.12.12.005>.
31. Zernicke KA, Campbell TS, Specia M, McCabe-Ruff K, Flowers S, Dirkse DA, Carlson LE (2013). The eCALM Trial-eTherapy for cancer appLying mindfulness: online mindfulness-based cancer recovery program for underserved individuals living with cancer in Alberta: protocol development for a randomized wait-list controlled clinical trial. *BMC Complement Altern Med*, 2013, 16;13:34, <https://doi.org/10.1186/1472-6882-13-34>.
32. Zhi WI, Baser RE, Zhi LM, Talukder D, Li QS, Paul T, Patterson C, Piulson L, Seluzicki C, Galantino ML, Bao T (2021). Yoga for cancer survivors with chemotherapy-induced peripheral neuropathy: Health-related quality of life outcomes. *Cancer Med*, 2021, 2;10(16):5456–5465, <https://doi.org/10.1002/cam4.4098>.