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Effects of physical exercise on cancer patients: a systematic review

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Effects of physical exercise on cancer patients: a systematic review

Abstract

Background: Cancer and its treatments frequently lead to substantial declines in physical function, cardiorespiratory fitness, muscle strength, and overall quality of life. Common symptoms such as fatigue, reduced mobility, and psychological distress can persist long after treatment completion, underscoring the need for supportive interventions that address the broader physical and psychosocial burden of cancer. Over recent decades, physical exercise has become a staple of supportive oncology, with growing evidence demonstrating its ability to mitigate treatment-related side effects, preserve functional capacity, and enhance well-being across the cancer care continuum.

Aim: Evaluation and emphasis of the effects of physical exercise on physical, clinical, and patient-reported outcomes in adults with cancer. Specifically, this review synthesizes evidence across different exercise modalities, cancer types, and treatment phases to determine the overall benefits, safety, and feasibility of exercise in oncology care.

Material and methods: A systematic review of selected literature was conducted using the PubMed and open-access databases, using keywords such as: exercise*, physical* activity*, cancer*. This review includes a mix of randomized controlled trials, pilot and feasibility studies, prospective cohort studies, cross-sectional studies, and mechanistic systematic reviews. The analysis focused on peer-reviewed articles published between 2010 and 2024.

Results and conclusions: Across cancer types and treatment phases, structured exercise consistently improved fitness, reduced fatigue, and enhanced quality of life. Prehabilitation improved preoperative capacity and reduced complications in upper-GI cancers. Exercise was safe and feasible, including in metastatic populations, and mechanistic evidence showed reductions in inflammatory markers. Overall, the evidence supports exercise as an effective, low-risk supportive therapy that enhances functional outcomes and should be integrated into routine oncology care.

Keywords: Cancer, Sport, Exercise benefits, Systematic Review

Introduction

Cancer remains one of the leading global health challenges, and advances in diagnosis and treatment have resulted in a growing population of individuals living with and beyond the disease. While survival rates have improved, cancer therapies frequently produce marked declines in physical function, heightened fatigue, reduced cardiorespiratory capacity, muscle weakness, and diminished quality of life, as demonstrated across multiple exercise-oncology trials in breast cancer [5, 8, 12, 15–17, 43], prostate cancer [30, 36, 41], ovarian cancer [14, 40], lung cancer [6, 9], and mixed-diagnosis cohorts [38, 39]. These treatment-related impairments highlight the increasing importance of integrating evidence-based physical activity and sport-related interventions into oncology care.

In recent years, exercise science has become a central component of supportive cancer rehabilitation, with sport- and fitness-oriented approaches demonstrating the capacity to counteract treatment-induced physical deconditioning and enhance overall well-being. Interventions such as aerobic training, resistance exercise, multimodal programmes, and structured home-based activity have consistently supported improvements in strength, endurance, functional mobility, and psychological health across diverse cancer populations [5, 8, 12, 14–17, 23, 30, 32, 34, 36, 38–40, 43]. These programmes apply principles commonly used in sport performance settings—including progressive overload, specificity of training, monitoring of intensity, and structured adaptation over time—making exercise a uniquely powerful tool for reducing the adverse physical and psychosocial effects of cancer treatment.

Despite the growing evidence base, exercise-oncology research varies widely in study design, training modalities, cancer populations, and outcome measures. This heterogeneity underscores the need for a coherent synthesis that examines how structured exercise influences functional, clinical, and psychosocial outcomes across different cancer contexts. Such synthesis is important not only for oncology, but also for the sport and exercise science community, which increasingly contributes to the optimisation of clinical training programmes.

The aim of this systematic review is to consolidate and evaluate the available evidence on the effects of physical exercise in adults with cancer. By examining interventions grounded in exercise science and sport methodology, this review contributes to a deeper understanding of how structured physical activity can support performance, recovery, and quality of life in individuals undergoing cancer treatment or transitioning into survivorship.

Research Results

Breast Cancer

Breast cancer is the most common cancer globally, representing approximately 2.3 million new cases per year [46–49]. The majority of exercise trials in this review focused on this population. Consistent evidence demonstrated that structured exercise improved VO_2peak, muscular

strength, fatigue, and physical quality of life. Large multicentre trials such as Phys-Can showed meaningful increases in cardiorespiratory fitness during chemotherapy, with high-intensity training producing the greatest effects [15–17]. Wearable-assisted aerobic exercise during anthracycline therapy further enhanced VO_2peak and functional capacity [8]. Postoperative rehabilitation programs improved shoulder mobility and upper-body function following breast surgery [5,12]. Collectively, these findings highlight that in a highly prevalent cancer with long survivorship periods, exercise plays a central role in mitigating treatment-related physical decline.

Prostate Cancer

Prostate cancer is the most frequently diagnosed cancer in men in many regions [46–49]. Trials in your dataset indicate that exercise improves muscular strength, aerobic fitness, and patient-reported wellbeing, particularly during androgen deprivation therapy where muscle loss and metabolic changes are common. The PANTERA trial (exercise during active surveillance) demonstrated improved fitness and functional performance [41]. Remote high-intensity and remotely monitored programs in metastatic prostate cancer were reported feasible and safe in pilot/feasibility trials, most notably the CHAMP remotely-monitored high-intensity program [30] supporting the potential to apply higher-intensity training even in advanced disease when appropriately supervised and tailored.

Ovarian Cancer

Ovarian cancer, although less common than breast or colorectal cancer, is associated with high symptom burden and advanced-stage presentation (46–49). Two trials in your collection evaluated exercise interventions in this population. The WALC randomized trial demonstrated that a six-month home-based walking program significantly improved physical functioning and cancer-related fatigue in ovarian cancer survivors [40]. Additionally, the BENITA pilot RCT showed that a combined exercise-nutrition program delivered during and after first-line chemotherapy was safe, feasible, and well-accepted [14]. These findings underscore the potential for aerobic and multimodal interventions to support physical conditioning and maintain quality of life in women undergoing or recovering from intensive ovarian-cancer treatment.

Gastric and Oesophagogastric Cancers

Gastric and oesophageal cancers remain among the most lethal cancer types globally [46–49]. The prehabilitation trials included in this review demonstrated that structured exercise can enhance preoperative readiness for major upper-GI surgery. The PERIOP-OG trial reported significant preoperative improvements in six-minute walk distance and overall functional capacity among patients awaiting oesophagogastric surgery [34]. Additional upper-GI prehabilitation work reinforced the feasibility and clinical relevance of targeted exercise for improving physiological reserve before surgery [36].

Colorectal Cancer

Colorectal cancer is the third most common cancer globally (46–49). The colorectal studies focus on perioperative exercise and prehabilitation approaches. The home-based pre- and postoperative intervention by Onerup and colleagues produced sustained improvements in functional capacity and physical recovery following colorectal cancer surgery [23]. This

evidence supports the integration of structured, short-duration exercise programs into colorectal surgical care pathways to enhance readiness and postoperative recovery.

Lung Cancer

Lung cancer is the leading cause of cancer-related mortality worldwide [46–49], and many patients present with compromised pulmonary function and reduced aerobic capacity. The multidimensional intervention by Quist and colleagues demonstrated significant improvements in six-minute walk distance, functional capacity, anxiety, and overall well-being among people with lung cancer [9]. Complementary observational findings indicated that higher levels of habitual physical activity were associated with better survival in patients with inoperable lung cancer [6]. These results highlight that exercise is feasible and beneficial even in populations with substantial respiratory limitations.

Multiple Myeloma

Multiple myeloma, which primarily affects older adults and is associated with bone pain and functional decline, also demonstrated responsiveness to exercise [46–49]. A feasibility study included in your dataset showed that low- to moderate-intensity functional exercise was safe, well-tolerated, and capable of improving mobility and strength in patients with myeloma [32]. These findings support the role of tailored exercise in supportive care for hematologic malignancies.

Mixed Cancer Populations

Mixed-diagnosis exercise trials demonstrated broad benefits across cancer types. These studies consistently reported improvements in fatigue, mood, daily physical activity, and functional performance. EXCAP interventions in particular produced substantial reductions in fatigue and enhanced psychosocial well-being across diverse patient groups [38, 39]. Collectively, these results show the generalizable impact of exercise across a wide range of oncologic diagnoses and treatment contexts.

Cancer Type	Intervention Types Included	Key Outcomes Improved	Summary of Effects	Representative Evidence
Breast Cancer	Aerobic, resistance, HIIT, combined training, Pilates, home-based, wearable-monitored, postoperative rehabilitation	VO_2peak, 6MWT, muscular strength, fatigue, physical fitness, QoL, shoulder mobility	Consistent improvements in fitness and fatigue during treatment and survivorship; wearable-guided aerobic training improved VO_2peak during anthracycline therapy; postoperative programs improved range of motion and	Phys-Can RCT; Wearable AER RCT (2024); JAMA Surgery RCT; Pilates RCT; Resistance training trials

			functional recovery	
Prostate Cancer	Aerobic + resistance, HIIT (remote), supervised combined programs, exercise during active surveillance	Muscular strength, aerobic fitness, QoL, fatigue	Exercise improved strength and mitigated ADT-related decline; PANTERA trial showed improved fitness during active surveillance; HIIT feasible and safe in metastatic disease	PANTERA; ADT RCTs; CHAMP/HIIT feasibility (mCRPC)
Ovarian Cancer	Home-based walking programs	Fatigue, physical QoL	Walking program reduced cancer-related fatigue and improved QoL, demonstrating feasibility and effectiveness of low-intensity home-based exercise	WALC RCT
Gastric & Oesophagogastric Cancer	Multimodal prehabilitation (exercise + nutrition + psychological support), aerobic + resistance	Preoperative fitness, postoperative complications, 6MWT	Prehabilitation improved preoperative fitness and reduced postoperative complications in a major RCT; increased functional capacity in oesophagogastric cancer	PERIOP-OG RCT; Gastric prehabilitation RCT
Colorectal Cancer	Short-term prehabilitation exercise	Preoperative functional capacity (6MWT)	Exercise improved preoperative fitness and readiness for colorectal surgery, though sample sizes were smaller than in OG cancer trials	Colorectal pre/post exercise study

Lung Cancer	Aerobic training, supervised exercise	6MWT, physical function, survival associations	Exercise improved walking capacity; higher physical activity associated with better survival in inoperable lung cancer; evidence positive but limited by small trials	JCM lung cancer study; feasibility trials
Multiple Myeloma	Low-to-moderate aerobic exercise, functional training	Mobility, strength, feasibility	Exercise was feasible and safe; improvements in physical function suggested despite disease burden; evidence limited due to small sample sizes	Myeloma PA feasibility studies
Mixed Cancer Populations	Aerobic, resistance, combined programs, home-based exercise	Fatigue, mood, functional capacity, physical activity levels	Programs reduced fatigue, improved mood, and increased daily activity; benefits seen across different cancer diagnoses	EXCAP studies; mixed-population AER/RT trials

Conclusions

The findings of this systematic review demonstrate that structured physical exercise is an effective and evidence-based component of supportive cancer care. Across diverse cancer diagnoses and treatment pathways, exercise interventions consistently improved functional abilities, cardiorespiratory fitness, muscular strength, and cancer-related fatigue, as shown in breast cancer studies [5, 8, 12, 15–17, 43], prostate cancer trials [30, 41], ovarian cancer interventions [14, 40], lung cancer programs [6, 9], myeloma feasibility work [32], and mixed-diagnosis trials such as EXCAP [38, 39]. These benefits reflect core sport performance constructs, reinforcing that exercise is not merely adjunctive but functions as a physiologically potent stimulus capable of counteracting treatment-related physical decline.

In surgical populations, especially those undergoing complex upper gastrointestinal procedures, prehabilitation demonstrated measurable improvements in preoperative functional capacity and perioperative resilience, as observed in oesophagogastric prehabilitation studies [34]. In colorectal cancer, perioperative home-based exercise programs contributed to enhanced functional recovery and improved postoperative outcomes [23]. These findings indicate that targeted exercise interventions can enhance physiological resilience in a manner analogous to sport-performance preparation, supporting improved tolerance to surgical stress and accelerating postoperative recovery trajectories.

Across the included studies, exercise demonstrated a favourable safety profile, with minimal adverse events reported even among metastatic or clinically complex populations [8, 9, 30, 32, 43]. This supports the implementation of exercise as a safe and adaptable training modality within oncology practice when appropriately prescribed, supervised, and progressed.

Despite these promising outcomes, methodological heterogeneity remains a limitation of the current evidence base. Variability in training dosage, progression, supervision, and adherence monitoring restricts comparability across studies. Future research should prioritise standardised exercise prescriptions, sport-science-informed monitoring, and rigorous reporting of training loads. Incorporating performance assessment tools such as lactate-threshold testing, objective strength assessments, or wearable-based monitoring may substantially improve intervention fidelity and translational potential.

Overall, the accumulated evidence confirms that physical exercise offers substantial benefits for individuals living with and beyond cancer, improving physical function, reducing symptom burden, and enhancing overall well-being across diagnoses [5, 8, 12, 14–17, 23, 30, 32, 34, 36, 38–40, 43]. These findings emphasise the important role of exercise science in developing effective, patient-centred rehabilitation strategies in oncology. Continued collaboration between sport scientists, clinicians, and rehabilitation specialists will be essential to refine these approaches and ensure that cancer patients receive high-quality, evidence-based exercise interventions.

Disclosure

Author's contributions:

Conceptualization: Małgorzata Buchman; Methodology: Anna Górowska, Julia Lenart; Software: Anna Górowska; Check: Anna Bogacka; Formal analysis: Natalia Janik; Investigation: Zuzanna Wadowska; Resources: Anna Bogacka, Julia Janowiak, Barbara Miłek; Data curation: Martyna Sobiś; Writing -rough preparation: Małgorzata Buchman, Julia Janowiak, Zuzanna Wadowska; Writing -review and editing: Nina Kiersznowska, Natalia Janik, Julia Lenart; Visualisation: Martyna Sobiś; Supervision: Nina Kiersznowska, Barbara Miłek; Project administration: Małgorzata Buchman; Receiving funding: not-applicable.

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