



## Importance of performance status and physical activity in cancer patients

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### Summary

**Background** This review summarizes current data on the effects of exercise interventions and physical activity in cancer prevention, treatment and related side effect management, as well as on the rehabilitation of cancer patients.

**Patients and methods** The overall quality of patient studies is still poor due to methodological limitations. Major limitations of the interventional exercise studies conducted include their designs, with regard to missing randomization or the absence of control groups, and the use of heterogeneous assessment methods to quantify and objectify physical activity. As a result, there are no specific exercise recommendations in cancer patients as yet that would essentially differ from exercise recommendations for healthy subjects. Nevertheless, due to major findings and empirical data, the field of research into exercise- and physical activity-related effects on disease and therapy-associated aspects is young and rapidly emerging.

**Conclusion** Exercise potentially contributes to the prevention and rehabilitation of cancer and represents a powerful tool in the prevention of various side effects under chemotherapy. Current data from interventional studies show preliminary positive effects for diverse movement programs and especially through specific combinations of endurance and resistance training. Additional randomized controlled trials with standardized assessments and controlling for potential confounders are needed to confirm and expand these findings.

**Keywords** Exercise · Movement recommendations · Cancer · CRCI · Cognition

Cancer is one of the world's largest health problems and, along with cardiovascular disease, one of the leading causes of death. The individual "age-adjusted" risk of death decreased between 2014 and 2019 for most types of cancer, which is primarily due to the developments and improvements in screening and treatment modalities in recent years [1–3]. Despite these successes and new treatment options, the time under and post treatment for patients is often associated with long-term impairments [3]. With reduced mortality, cancer and its treatment-related morbidity moved into the focus of research [4, 5].

In oncology, movement and training interventions as forms of therapy have long been neglected and received little welcome. In addition to the three main blocks of oncological treatment, which remain surgical, radiation and drug therapy, sport and movement therapy were virtually unused. Physical activity was considered to be unknown and unsafe. In the past few years, however, there has been a noticeable change. Exercise therapy and sport seem to have been finding their way into oncological rehabilitation more and more, becoming a permanent pillar of modern oncology. The reason for this can be seen through the positive effects that result from numerous studies examining physical activity and cancer in detail. In addition to the scientific findings, practical experiences demonstrate that physical activity and sports are safe, powerful and supportive tools in oncological therapy [6, 7]. It is now well known that physical activity lowers the risk of cancer and mortality and that it can significantly reduce the incidence of disease and treatment-specific side effects such as nausea, vomiting, reduced bone density, cardiac toxicity, cancer-

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related fatigue, depression, lymphedema and incontinence [8–10]. This directly results in an increase in patient quality of life both during and after therapy.

The majority of studies have investigated the effects of exercise on neurocognitive side effects under chemotherapy on the basis of the broad field of studies conducted in patients with neurodegenerative diseases.

Therefore, there is strong evidence for the benefits of aerobic endurance training, anaerobic exercise and the correlates of daily physical activity levels on patients with neurodegenerative diseases such as dementia, Alzheimer's, as well as depression and fatigue, as often seen in cancer patients [11–13]. Several studies show that the neuroprotective effects of exercise are achieved through a number of neuronal biochemical mechanisms, such as increased cerebral angiogenesis, as well as hippocampal neurogenesis and plasticity [14–16].

In addition to the above-mentioned benefits, it is known that physical activity, regardless of the type of cancer, has positive effects on the structural changes of the central nervous system [12]. Current studies indicate that both long and short exercise units significantly increase cognitive functions of juvenile as well as adult patients in specific neurocognitive tasks [17, 18].

Besides aerobic exercise, other types of training, such as resistance training [19, 20], have been under investigation. In particular a combination of resistance and endurance training, as well as alternative forms of core-stability training such as yoga, tai chi or qigong, have been associated with positive effects [21].

Exercise and physical activity have therefore received increasing attention in the field of rehabilitation and as a possible treatment component that can be safely, feasibly and effectively carried out [4, 8].

Constant physical activity during treatment reduces not only side effects, but also recovery times between and after therapy and ultimately enhances patient survival [22–24].

Patients that consistently exercise are in much better general condition, fitter despite chemotherapy and show fewer cardiovascular problems, states of exhaustion or depression.

Exercise therapy can be started at a very early stage of patient care. Physical training for cancer patients, especially post-surgery, is based on initial mobilization exercises, which can be carried out in the hospital 24h after surgery. However, this should only be done as part of a physiotherapeutic process and under supervision by a therapist. Endurance and resistance training at this stage leads to an increase in mobility, a reduction in the side effects of cancer therapy and consequently an increase in quality of life.

Specific goals in cancer patients due to the type of entity can include:

- Avoiding muscle shortening
- Compensation of strength deficits
- Reduction and prophylaxis of lymphedema
- Contracture prophylaxis; reduction of restricted mobility
- Treatment and prevention of osteoporosis
- Improvement in general fitness
- Improvement of body strength and self-esteem
- Reduction of fatigue
- Improvement of quality of life

The main types of exercise suggested for cancer patients are endurance sports. Recommendations include swimming, cycling and walking, amongst many others. In sports that require the use of poles, such as cross-country skiing and Nordic walking, breast cancer patients in particular should be made aware to only exercise after the surgical site has completely healed due to the high level of arm use.

Another important pillar of rehabilitation is water therapy. To avoid overexertion, patients should start with light water aerobics. Positive aspects of water therapy include the low risk of injury and the improved lymphatic circulation through the hydrostatic pressure.

Research in the application of resistance training is still sparse; however, light strength training as an essential supplementary method of exercise therapy in an oncological setting is already being regularly adopted and is recommended at least once a week. Strength endurance is recommended when training with weights, which should be carried out under therapeutic supervision including monitoring of exercise intensity, blood pressure, heart rate and subjective well-being.

### Take home message

With regard to the various training modalities, supervised one-on-one support, training units in group settings, as well as self-performed home training can be recommended. The question as to the level at which training is effective and which load intensities are needed to reproduce or amplify the above-mentioned positive effects needs to be investigated in further studies.

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