

Robson Hidalgo

2024 Fall Physiology Muscular Activity FNES 342 NEX [41145] [Lecture] [Queens College]

Professor: Bridget A. McFadden, PhD, CSCS*D

December 13, 2024

Muscular Physiology Literature Review

The Role of Aerobic Physical Activity in Cancer Treatment: A Comprehensive Review

Abstract

Over the years, cancer patients' interest in how aerobic physical exercise (APA) may result in an enhanced survival rate and enhancement in the quality of life and mental health outcomes has grown. This review investigates, with respect to its function in cancer treatment, the effects of aerobic exercise on cardiovascular health, cardiotoxicity, and depression. Furthermore, the paper critically analyzes different methodologies used in selected studies, focusing on subject demographics, the instrumentation of measures, and the analysis techniques applied to assess the efficacy of APA. It also presents key molecular mechanisms through which physical exercise prevents chronic inflammation and promotes tissue healing, thus informing its therapeutic effects. Although medical guidelines recommend that cancer patients engage in at least 150 minutes of moderate-intensity aerobic activity exercise per week, with strength training exercises at least twice per week, standardization of an exercise program within this highly diverse population is the biggest challenge. In conclusion, studies shall be done to bridge the remaining gaps in terms of designing an exercise prescription specific to cancer stages throughout the treatment and survivorship phases so that regular physical activity can become part of standard cancer treatment.

Keywords: Cancer treatment, aerobic exercise, cardiovascular health, depression, physical activity guidelines, cardiotoxicity.

Introduction

It will become necessary to provide novel, multi-modal interventions that go beyond medicine for the treatment of increasing incidents of cancer. As shown below, it is anticipated that by the year 2024, there will be a diagnosis of 2.001 million new cases in the United States alone (NCI, 2024). Recent studies suggest that APA might improve the quality of life and efficacy of therapy for cancer patients (American Cancer Society, 2022). The cancer statistics show that a variety of therapy modalities are urgently required. The National Cancer Institute projects that roughly 40.5% of men and women will have cancer at some point throughout life. Moreover, physical activity is connected with better cancer survival since it can lower the possibility of recurrence. This review underlines the available knowledge on the function of aerobic exercise in cancer treatment concerning cardiovascular mortality, cardiotoxicity, quality of life, and mental health. The literature identified some gaps, which have been proposed as subjects of the following studies.

Background and Problem Statement

According to the Cleveland Clinic (2023), aerobic exercise refers to the sustaining physical activity that engages the major muscle groups and enhances cardiorespiratory fitness. Physical activities might provide cancer patients with additional benefits since this was noted to improve overall health and alleviate specific adverse effects from the treatments (Misiag, 2022). The enhancements in the health status of cancer patients entail a price: Cancer therapies frequently induce long-term detrimental health effects, such as cardiotoxicity, fatigue, and mental health disorders, including depression and anxiety (American Cancer Society, 2024). Walking, cycling, swimming, and other aerobic activities have been found to lessen these effects

and increase cardiovascular fitness, therefore decreasing fatigue and emotional stress (Mayo Clinic Staff, 2023). Either in current treatment or during extended survival therapy, most cancer patients lack appropriate exercise regimens and therapies to fit their different needs.

Given these concerns, this review aims to synthesize available literature in regard to the benefits that can be derived from aerobic physical activity among cancer patients. It develops an evidence-based appreciation of both physiological and psychological effects. With particular attention to cardiovascular health, depression, and fatigue, this study will look at several types of research, including meta-analyses and randomized controlled trials, which explore the function of exercise within cancer treatment.

Literature Review

Cardiovascular Health and Cancer Treatment

Studies on aerobic exercise have mostly focused on many cardiovascular advantages, one of which is for cancer patients who run a great risk for radiation and chemotherapy effects. Coma et al. (2023) claim that exercise drastically lowers cardiotoxicity and cardiovascular mortality, two often noted side effects of cancer therapy. Long-term cardiovascular problems in cancer survivors cause heart damage by chemotherapy drugs such as anthracyclines and trastuzumab (Cleveland Clinic, 2022). Studies claim that aerobic activities could enhance cancer patients' cardiovascular system performance, endothelial function, and exercise capacity, thus countering chemotherapy-related adverse effects (Zimmerman et al., 2024). Comparatively to those with lower levels of physical activity before diagnosis, a prospective observational cohort study - the first of its kind involving humans - demonstrated that elevated levels of physical activity prior to cancer diagnosis linked with lower risks of cardiovascular events (CVEs) in women with breast

cancer (Zimmerman et al., 2024). This is reflected in the weight that the review gives to the inclusion of aerobic exercise in cancer treatment, not only for the prevention of cardiovascular problems resulting from treatments but also for improving quality of life.

Exercise and Depression in Cancer Patients

Depression and anxiety are conditions most often reported by cancer patients and survivors-more so because of the emotional and physical tolls of chemotherapy and other therapies (Kulchyski et al., 2024). These conditions are significant points of concern in terms of such patient's quality of life and treatment and recovery. The Mayo Clinic documented that exercise can significantly mitigate symptoms of anxiety and depression, which are prevalent among cancer patients, and advocates for exercise as a crucial component of cancer care. As described by the Mayo Clinic, these regular exercises assist with such conditions through endorphin stimulation, gain confidence, and decrease the level of stress.

A systematic review of randomized clinical trials indicated that APA is significantly associated with decreased depressive symptoms in patients with cancer (Kulchyski et al., 2024). It was conducted on 25 trials comprising 1,931 adults with different cancer types. This established that participants who were subjected to APA had better scores for depression immediately after intervention and six months after the intervention. Most of these studies were conducted with adult (18-80-year-old) cancer patients and represented different types of cancers to ensure proper understanding in different population groups. The therapeutic effects of APA were demonstrated by both experimental (comparing APA to normal treatment) and correlational investigations, which showed significant reductions in depression symptoms as measured by validated instruments (Kulchyski et al., 2024). The Hospital Anxiety and Depression Scale

(HADS) and the Center for Epidemiologic Studies Depression Scale (CES-D) were often used tools that showed good validity and reliability in oncology settings (Kulchyski et al., 2024). Similarly, Mid-Atlantic Permanente Medical Group (2021) explains that physical activity influences the neurochemical systems that regulate mood states, such as serotonin and dopamine. Maintaining emotional balance in depression is mostly dependent on these neurotransmitters, so their functioning can be compromised. Thus, aerobic activities lower depressed symptoms and restore emotional stability using manipulation of these neurochemicals, hence improving the mental state of cancer patients.

Among cancer patients, exercise seems to be rather important for a better life since it increases general energy levels, reduces fatigue, and improves physical ability. Regular exercise increases strength, endurance, and mobility, but rehabilitation usually leads to the loss of these qualities. Exercise helps cancer patients feel more empowered and experience less anxiety by returning control over their bodies. These psychological benefits should prove to be significantly advantageous for cancer patients who occasionally experience feelings of powerlessness or are overwhelmed by the psychological, emotional, and physical challenges associated with obtaining a diagnosis and enduring treatment side effects.

Mechanisms Underlying the Benefits of Exercise

Although the physiological mechanisms by which aerobic exercise benefits cancer patients are yet unknown, some critical pathways have since been established. In this sense, Feng et al. (2024) note that an exercise mode may strengthen immune function through higher blood circulation of immune cells, T-cells, and natural killer cells. These immune cells define whether tumor cells are found and destroyed. As a result, it promotes bodily immunity to combat cancer

and prevent recurrence. Thus, regular aerobic exercise can significantly build the immune system so that cancer patients may better cope with the condition and raise their chances of long-term survival.

Furthermore, underlined by Feng et al. (2024), the importance of exercise in lowering chronic inflammation is a major contributor to cancer advancement and a determinant of side effects following treatments. Common among cancer patients, chronic inflammation fuels tumor development, metastases, and aggravation of the side effects linked with therapy. While increasing the release of anti-inflammatory cytokines, aerobic exercise has been linked to lowering pro-inflammatory cytokine levels. It helps a patient recover and restore better health by changing the body's inflammatory response to more efficiently repair tissues and lower collateral damage from intense cancer treatments, including chemotherapy and radiation.

Even as the benefits of exercise during cancer treatment are becoming better known, challenges remain in ensuring patient adherence to the recommended exercises. For instance, Wendler (2022) noted that most cancer patients have no idea how exercise might help enhance general health or treatment outcomes. Even as the benefits of exercise during cancer treatment are becoming better known, challenges remain in ensuring patient adherence to the recommended exercises. For instance, Wendler (2022) noted that most cancer patients have no idea how exercise might help enhance general health or treatment outcomes. Numerous factors influence how people exercise, including lack of time, type of exercise, and an absence of exercise, and the minds of many exercise and cancer don't go together. Wendler affirms that beating these kinds of challenges needs individualized exercise plans targeting every patient's specific needs and situations. Similarly, healthcare professionals should provide individualized,

achievable, and enjoyable physical activities to achieve a higher possibility of continued exercise and enhanced quality of life for cancer survivors.

Practical Guidelines for Incorporating Exercise into Cancer Care

The integration of exercise into cancer care for each patient must be individualized in order to take into consideration the various stages of cancer treatment and survivorship. Different cancer patients may work with varying levels of physical activities, all of which should be factored into developing exercise programming (Wendler, 2022). Current guidelines by the American Cancer Society (2022) and Cancer Research UK (2023) state that patients should engage in at least 150 minutes weekly of moderate-intensity activity together with at least twice weekly strength training sessions. For example, brisk walking, cycling, swimming, gardening or housework, and strength for example, weight training or yoga. The above recommendations are foundational in the data exercise and can foster general wellness, help relieve fatigue, and improve physical fitness.

Therefore, given the expectations, goals, and particular circumstances of the patient, it becomes necessary to create tailored workout routines in such a way that they are practical and motivating, which leads to better adherence and health advantages.

Conclusion

This literature review highlights increasing evidence that supports aerobic physical activity as a treatment for cancer: The cardiac health benefits, the mental health issues to lessen the symptoms of depression, and the quality of life generally improved in patients with cancer. Despite the benefits, there has not been enough research into different types of exercise, their

effectiveness, or at what stage in the cancer process and its treatment. Furthermore, strategies to maximize patient adherence to exercise programs are highly warranted since lifelong physical activity is needed to maximize the benefits of exercise in cancer management. Finally, the integration of exercise into standard cancer care has the potential to optimize significantly both physical and psychological quality of life in cancer patients and survivors.

References

- American Cancer Society. (2024). *Late and Long-term Effects of Cancer*. American Cancer Society. <https://www.cancer.org/cancer/survivorship/long-term-health-concerns/long-term-side-effects-of-cancer.html>
- American Cancer Society. (2022). *Physical activity and the person with cancer*. American Cancer Society. <https://www.cancer.org/cancer/survivorship/be-healthy-after-treatment/physical-activity-and-the-cancer-patient.html>
- Cancer Research UK. (2023). *Exercise guidelines for cancer patients*. Cancer Research UK. <https://www.cancerresearchuk.org/about-cancer/coping/physically/exercise-guidelines>
- Cleveland Clinic. (2023). *Aerobic Exercise: What It Is, Benefits & Examples* <https://my.clevelandclinic.org/health/articles/7050-aerobic-exercise>
- Cleveland Clinic. (2022). *Cardiotoxicity: Cancer Treatment and the Heart* <https://my.clevelandclinic.org/health/diseases/16858-chemotherapy--the-heart-cardiotoxicity>
- Coma, N., Moral, S., Ballesteros, E., Eraso, A., Ventura, M., Pujol, E., Brugada, R. (2023). Current evidence on the benefit of exercise in cancer patients: Effects on cardiovascular mortality, cardiotoxicity, and quality of life. *Revista Cardiovascular de Medicina*, 24(6), 160. <https://doi.org/10.31083/j.rcm2406160>
- Feng, Y., Feng, X., Wan, R., Luo, Z., Qu, L., & Wang, Q. (2024). Impact of exercise on cancer: Mechanistic perspectives and new insights. *Frontiers in Immunology*, 15. <https://doi.org/10.3389/fimmu.2024.1474770>

Kulchyski, M., Halder, H. R., Askin, N., Rabbani, R., Schulte, F., Jeyaraman, M. M., Sung, L., Louis, D., Lix, L., Garland, A., Mahar, A. L., Abou-Setta, A., & Oberoi, S. (2024).

Aerobic physical activity and depression among patients with cancer: A systematic review and meta-analysis. *JAMA Network Open*, 7(10), e2437964.

<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2824547>

Mayo Clinic Staff. (2023). *Aerobic exercise: Top 10 reasons to get physical*. Mayo Clinic. <https://www.mayoclinic.org/healthy-lifestyle/fitness/in-depth/aerobic-exercise/art-20045541>

Mayo Clinic Staff. (2023). *Depression and anxiety: Exercise eases symptoms*. Mayo Clinic. <https://www.mayoclinic.org/diseases-conditions/depression/in-depth/depression-and-exercise/art-20046495>

Mid-Atlantic Permanente Medical Group (2021). *Regular Exercise Benefits Both Mind and Body: A Psychiatrist Explains* <https://mydoctor.kaiserpermanente.org/mas/news/regular-exercise-benefits-both-mind-and-body-a-psychiatrist-explains-1903986>

Misiąg, W., Piszczyk, A., Szymańska-Chabowska, A., & Chabowski, M. (2022). Physical activity and cancer care—a review. *Cancers (Basel)*, 14(17), 4154. <https://doi.org/10.3390/cancers14174154>

National Cancer Institute. (2024). *Cancer statistics*. U.S. National Institutes of Health. <https://www.cancer.gov/about-cancer/understanding/statistics#:~:text=Approximately%2040.5%25%20of%20men%20and,will%20die%20of%20the%20disease>

Wang, Q., & Zhou, W. (2021). Roles and molecular mechanisms of physical exercise in cancer prevention and treatment. *Journal of Sport and Health Science*, 10(2), 201-210. <https://doi.org/10.1016/j.jshs.2020.07.008>

Wendler, R. (2022). Exercise during cancer treatment: 4 things to know. *MD Anderson Cancer Center*. <https://www.mdanderson.org/cancerwise/exercise-during-cancer-treatment--4-things-to-know.h00-159543690.html>

World Health Organization. (2024). Physical activity. *World Health Organization*.
<https://www.who.int/news-room/fact-sheets/detail/physical-activity>

Zimmerman, A., Planek, M. I. C., Chu, C., Oyenusi, O., Paner, A., Reding, K., Skeete, J., Clark, B., & Okwuosa, T. M. (2020). Exercise, cancer and cardiovascular disease: what should clinicians advise?. *Cardiovascular endocrinology & metabolism*, 10(2), 62–71.
<https://doi.org/10.1097/XCE.0000000000000228>