PHYSICAL EXERCISE PREVENTION AND TREATMENT OF CANCER PATIENTS

EXERCÍCIO FÍSICO PREVENÇÃO E TRATAMENTO DE PACIENTES ONCOLÓGICOS

PREVENCIÓN Y TRATAMIENTO DEL EJERCICIO FÍSICO EN PACIENTES CON CÁNCER

https://doi.org/10.56238/sevened2025.031-004

Tássia Corrêa Soares[1], Milena Fernanda Lopes da Silva[2], Sabrina Ramires Sakamoto[3], Julio Cesar Rodrigues[4], Lucas Agostini[5], George Petrallas[6], Guilherme Akio Tamura Ozaki[7], Donaldo Aparecido Campos Filho[8], Fernando Fabrizzi[9]

ABSTRACT

According to the WHO (World Health Organization), in 2022 alone, there was a 20 million increase in the number of individuals with cancer worldwide. Data from the Ministry of Health show that there is a growing and early rise in sedentary lifestyles and obesity, thus leading to higher cases of chronic diseases, including cancer. Therefore, people's adherence to physical exercise programs could prolong the lives of many cancer patients, allowing them to achieve better health and reduce treatment costs, which could lead to better socioeconomic conditions for society as a whole. Understanding the role of physical exercise in the side effects of cancer treatment (chemotherapy and radiotherapy), as well as possible interference with the tumor and recurrence of this disease, is of fundamental importance, both

[1]Graduated in Physical Education. Faculdade de Filosofia, Ciências e Letras de Penápolis.
E-mail: tassia.soares12154@alunos.funepe.edu.br ORCID:https://orcid.org/0009-0009-7791-9174
Lattes:http://lattes.cnpq.br/5157800138475150
[2]Graduated in Physical Education. Faculdade de Filosofia, Ciências e Letras de Penápolis.
E-mail: milena.silva11669@alunos.funepe.edu.br ORCID: https://orcid.org/0009-0001-5098-6635
Lattes:https://lattes.cnpq.br/9323827546068728
[3]Dr. in Nurse. Faculdade de Filosofia, Ciências e Letras de Penápolis. E-mail: ramiressabrina@funepe.edu.br
ORCID: https://orcid.org/0000-0003-0189-7043 Lattes: http://lattes.cnpq.br/1830479741308872
[4]Dr. in Physical Education. Faculdade de Filosofia, Ciências e Letras de Penápolis.
E-mail: julio.rodrigues@funepe.edu.br ORCID: https://orcid.org/0000-0001-6551-393X
Lattes: http://lattes.cnpq.br/6660236240481509
[5] PhD in Science (Human Physiology). Faculdade de Filosofia, Ciências e Letras de Penápolis.
E-mail: lucas.agostini@funepe.edu.br ORCID: https://orcid.org/0000-0003-3898-5637
Lattes: http://lattes.cnpq.br/3472863879563335
[6]Master's Degree in Territorial Development and Environment. Faculdade de Filosofia, Ciências e Letras de Penápolis. E-mail: george.petrallas@funepe.edu.br ORCID: https://orcid.org/0000-0002-6053-4456
Lattes: http://lattes.cnpq.br/4328065440543594
[7]PhD in Surgical Sciences. Faculdade de Filosofia, Ciências e Letras de Penápolis.
E-mail: guilherme.ozaki@funepe.edu.br ORCID: https://orcid.org/0000-0002-0133-960X
Lattes: http://lattes.cnpq.br/4218579396180443
[8]Master's Degree in Territorial Development and Environment. Faculdade de Filosofia, Ciências e Letras de Penápolis. E-mail: donaldo.filho@funepe.edu.br ORCID: https://orcid.org/0000-0003-1688-806X
Lattes: http://lattes.cnpq.br/6911665126473900
[9] Dr. in Science. Faculdade de Filosofia, Ciências e Letras de Penápolis.
E-mail: ferfabrizzi@funepe.edu.br ORCID: https://orcid.org/0000-0002-6163-1514
Lattes: http://lattes.cnpq.br/1144207796332494

academically and for the health and well-being of society. Based on this premise, the central objective of this chapter was to seek and describe evidence that allows us to understand the benefits of physical exercise in cancer prevention and treatment of cancer patients. The authors observed a decrease in inflammatory molecules, increased longevity, a decreased risk of treatment toxicity, improved quality of life and patient survival, a decrease in disease recurrence, and a decrease in insulin resistance in patients undergoing cancer treatment who exercised. Thus, it was possible to conclude from the articles included in this systematic review that physical exercise improves quality of life, treatment fatigue, appetite, and sleep, in addition to reducing side effects in patients undergoing treatment and reducing the chance of disease recurrence.

Keywords: Sedentary Lifestyle. Healthy Lifestyle. Oncology.

RESUMO

Segundo a OMS (Organização Mundial de Saúde), somente em 2022 houve um aumento de 20 milhões de indivíduos com câncer no mundo. Dados do Ministério da Saúde apresentam que há um aumento crescente e precoce do estilo de vida sedentário e obesidade, acarretando assim maiores casos de doenças crônicas, dentre elas o câncer. Dessa forma, a adesão das pessoas a programas de exercício físico poderia prolongar a vida de vários pacientes oncológicos, permitindo obter mais saúde, diminuir os gastos com o tratamento, o que pode levar a melhores condições socioeconômicas da sociedade como um todo. Compreender o papel do exercício físico sobre os efeitos colaterais causados no tratamento do câncer (quimio e radioterapia), bem como sobre possíveis interferências no tumor e reincidência dessa doença é de fundamental importância, tanto em nível acadêmico quanto para a saúde e bem-estar da sociedade. Partindo desse pressuposto, o objetivo central do presente capítulo foi buscar e descrever evidências que permitam a compreensão dos benefícios do exercício físico na prevenção do câncer e no tratamento de pacientes oncológicos. Os autores observaram diminuição de moléculas inflamatórias, aumento da longevidade, diminuição no risco de toxicidade do tratamento, melhora da qualidade e na sobrevida dos pacientes, diminuição da reincidência da doença e diminuição da resistência à insulina em pacientes que foram submetidos ao tratamento de câncer e realizaram exercício físico. Assim, foi possível concluir por meio dos artigos incluídos na presente revisão sistemática que, a prática de exercícios físicos melhora a qualidade de vida, a fadiga do tratamento, o apetite e o sono, além de diminuir os efeitos colaterais de paciente em tratamento e reduzir a chance de reincidência da doença.

Palavras-chave: Sedentarismo. Estilo de Vida Saudável. Oncologia.

RESUMEN

Según la OMS (Organización Mundial de la Salud), solo en 2022 hubo un aumento de 20 millones de personas con cáncer en el mundo. Datos del Ministerio de Salud muestran que existe un aumento creciente y temprano del sedentarismo y la obesidad, lo que conlleva a mayores casos de enfermedades crónicas, entre ellas el cáncer. Así, la adherencia a programas de ejercicio físico podría prolongar la vida de muchos pacientes con cáncer, permitiéndoles alcanzar una mejor salud y reducir los costos del tratamiento, lo que podría conducir a mejores condiciones socioeconómicas para la sociedad en su conjunto. Comprender el papel del ejercicio físico en los efectos secundarios del tratamiento del cáncer (quimioterapia y radioterapia), así como la posible interferencia con el tumor y la recurrencia de esta enfermedad, es de fundamental importancia, tanto a nivel académico como para la salud y el bienestar de la sociedad. Partiendo de este supuesto, el objetivo central de este

capítulo fue buscar y describir evidencia que permita comprender los beneficios del ejercicio físico en la prevención del cáncer y en el tratamiento de pacientes con cáncer. Los autores observaron una disminución de las moléculas inflamatorias, un aumento de la longevidad, una disminución del riesgo de toxicidad del tratamiento, una mejora en la calidad y supervivencia de los pacientes, una disminución de la recurrencia de la enfermedad y una disminución de la resistencia a la insulina en pacientes que se sometieron a tratamiento contra el cáncer y realizaron ejercicio físico. Así, fue posible concluir a través de los artículos incluidos en esta revisión sistemática que la práctica de ejercicios físicos mejora la calidad de vida, la fatiga del tratamiento, el apetito y el sueño, además de reducir los efectos secundarios de los pacientes sometidos al tratamiento y reducir la posibilidad de recurrencia de la enfermedad.

Palabras clave: Estilo de Vida Sedentario. Estilo de Vida Saludable. Oncología.

1 INTRODUCTION

According to the WHO (World Health Organization), in 2022 alone there was an increase of 20 million individuals with cancer in the world. The census points out that mortality has reached one in nine men and one in twelve women and the prospects for the coming years are that one in five people will be affected by this disease throughout their lives [1].

Data from the Ministry of Health show that there is a growing and early increase in sedentary lifestyle and obesity, thus leading to greater cases of chronic diseases, including cancer. In this way, people's adherence to physical exercise programs could prolong the lives of several cancer patients, allowing them to obtain more health, reduce treatment expenses and thus lead to better socioeconomic conditions in society as a whole [2].

Studies have shown that regular exercise plays a crucial role in protecting against cancer development and, for those who have already faced the disease, can reduce the risk of recurrence and mortality. Therefore, promoting an active and healthy lifestyle is critical not only for cancer prevention but also for improving outcomes and quality of life for survivors [3].

Arising from two or more cells that undergo mutations or genetic alterations, cancer thus leaves the cells insensitive to anti-growth signals; performs tissue invasion and metastasis; it limits the replicative potential; causes evasion to apoptosis; it has sustained angiogenesis and self-sufficiency in signs of proliferation. Thus, cancer can be seen as a complex tissue, with distortion of the original tissue homeostasis [4].

Since physical exercise can promote changes in various tissues of the body, thus acting on the circulatory, musculoskeletal, endocrine and other systems, it stimulates the release of molecular substances with bioactive power, which can trigger multisystemic benefits [5]. Thus, physical exercise can act in an important way as a tool in controlling the proliferation of cancer cells [5], reducing the relative risk of development [6], recurrence [7] and mortality [8] developed by this disease.

From this perspective, it is necessary to understand the role of physical exercise on the side effects caused in cancer treatment (chemotherapy and radiotherapy), as well as to infer the possible interferences in the tumor and recurrence of this disease, which

is of fundamental importance, both at the academic level and for the health and well-being of society.

Based on this assumption, the main objective of this chapter was to seek and describe evidence on the benefits of physical exercise in the prevention and treatment of cancer patients.

2 PHYSICAL EXERCISES X PREVENTION AND TREATMENT OF CANCER PATIENTS

Orange and his collaborators (2022) [13] observed that, when they applied blood serum from volunteers conditioned to aerobic physical exercise to cancer cells, they caused their proliferation to decrease. In addition, they observed an increase in IL-6 (Interleukin 6) accompanied by a decrease in a protein of the histone family γH2A (γ-H2AX) (a molecule indicative of damage to Deoxyribonucleic Acid (DNA). Thus, the authors suggest in their conclusions that physical exercise acutely promotes an increase in the regulatory effect of IL-6 on DNA damage, thus leading to a decrease in the proliferative process of colon cancer cells.

In addition, Guércio et al. (2019) [14] observed, when analyzing treatment responses, that the practice of physical activity at moderate or light intensity was associated with longer overall survival, longer life without disease progression (PFS), and lower risks of treatment-related toxicities in patients with colorectal cancer. For the authors, there is still a need for further studies, however, they see the importance and need to include the practice of physical activity in the treatment routine of patients with colorectal cancer.

Schwappacher et al. (2020) [15] also studied the effect of electrical pulses, mimicking the practice of physical exercises in serum of patients with advanced prostate and colorectal cancer. The patients were submitted to treatment with electrical pulses and serum was extracted from them, which was inserted into cell cultures of prostate and colorectal cancer *in vitro,* in order to investigate possible interventions. According to the authors, serum from patients with advanced cancer inhibited proliferation and increased apoptosis of human prostate and colon cancer cells *in vitro*. Thus, the authors suggested conclusions that lead to believe that stimulation by electrical pulse also impairs the

viability of human cancer cells, thus reporting the importance of physical exercise in controlling the development and treatment of colorectal and prostate cancer.

In a 2022 study, Galvão et al. (2022) [16] report the importance of intervention, even at a distance, through physical exercise and healthy eating in patients with prostate cancer undergoing androgen deprivation treatment, since these measures can lead to an increase in body fat and a decrease in muscle mass, which intensifies the risks of comorbidities and mortality from cardiovascular and metabolic diseases. Thus, the authors warn about the importance of inserting measures that include physical exercise and changes in dietary quality, thus leading to improved quality of life, physical and psychological health, in addition to reducing side effects related to treatment.

In a convergent way, Hughes et al. (2019) [17], and Galvão et. al. [2020] also reinforce the importance of including counseling on healthy eating and regular physical exercise. According to them, there is sufficient scientific evidence to support the inclusion of healthy eating and regular exercise in the guidelines for prostate cancer survival, and that these measures should become a priority in setting the agenda for patient survival.

When analyzing 3813 women in a cohort study, Jung et al. (2019) observed that even though they were insufficiently physically active before the diagnosis of breast cancer, they significantly reduced total mortality by 50% when they started to increase the practice of post-diagnosis physical activity to recommended levels. In addition, they reduced breast cancer mortality by 46% and obtained a 42% improvement in recurrence-free survival, when compared to insufficiently active women. In conclusion, the authors report the importance of physical exercise in both the prevention and treatment of breast cancer.

In order to corroborate the previously reported findings on the importance of physical exercise in the prevention and treatment of breast cancer, Viskochil et al. (2020) [19], also found promising results in their study. When they assessed Peak Oxygen Volume (VO2peak), body weight, and fasting insulin values, they observed significant improvements, suggesting that exercise is critical for breast cancer survivors after treatment.

Also, Completo et al. (2021) [20] observed a significant association between low levels of insulin, C-reactive protein, and insulin resistance in breast cancer survivors who

practiced moderate and intense physical activity. Thus, the authors reinforce the importance of physical activity in the post-treatment follow-up of breast cancer.

Subsequently, Brown et al. (2023) [21], when evaluating whether physical exercise and diet would be able to promote changes in the hormonal parameters of postmenopausal breast cancer survivors, found no significant differences.

Patients showed significant improvements in endurance capacity, fatigue, and quality of life of breast cancer patients who participated in a pilot study. According to the authors Cenik et al. (2019) [22], even though the study had a small number of participants, it indicated important findings, since four of the five patients showed significant improvements, demonstrating that the physical exercise intervention confirmed its effectiveness.

Chang et al. (2020) [23] observed that inducible signaling pathway protein-1 Wnt1 (WISP-1) and β-catenin, key mediators in the integration site growth factor (Wnt) signaling pathway, decreased, along with improvement in metabolic parameters during and after exercise training. Since there is a link between tumorigenic insulin signaling and the WISP-1 pathway, it is concluded that exercise training can improve the metabolic and tumor parameters of women recovered from breast cancer.

When assessing the relationship between Hispanic and non-Hispanic women who are breast cancer survivors, Dieli-Conwright et al. (2019) [24] observed important differences. The authors reported a greater propensity to be affected at a more advanced stage, with younger age groups and higher levels of adiposity in Hispanic women. However, when submitted to physical exercise, they showed a shortening of this disparity, moderating blood glucose, triglyceridemia and C-reactive protein values more effectively, showing how fundamental this intervention is as a tool in the treatment of the disease, especially in women of this ethnicity.

3 SUMMARY AND FINAL CONSIDERATIONS

As previously described, there is a growing increase in cancer patients every year, accompanied by great advances in science in this context. However, as promising as the discoveries about the treatment and prevention of this disease have been, there is still a long and arduous road ahead. Therefore, the search for tools that help both in the

treatment and prevention of cancer is of fundamental importance. The present review found evidence of the importance of physical exercise as an auxiliary tool in treatment (maximizing its effects against the tumor and minimizing the side effects of treatment), in the prevention of tumor recurrence after treatment, and in the psychophysiological recovery of the patient after treatment.

In summary, it can be observed that the findings of the present review focus on findings focused on the benefits of physical exercise in patients with colon/rectal cancer, prostate, and breast:

Colon Cancer

- Increased IL6, decreased yH2AX, increases tumor cell apoptosis (Orange et al., 2022) [13];
- Decreases tumor cell progression, treatment toxicity, and increases survival of non-tumor cells (Quércio et al., 2019) (*in vitro*).

Prostate Cancer

- Increased IL6, decreased yH2AX, increases tumor cell apoptosis (Orange et al., 2022) (*in vitro*);
- Decreases the side effects of the treatment; increases quality of life, physical and psychological health (Galvão et al., 2022);
- Increases post-treatment patient survival (Hughes et al., 2022).

Breast Cancer

- Decreases tumor mediators through the Wnt insulin pathway (Wsp-1 and Beta Caterain); decreases blood glucose, triglyceridemia, and C-reactive protein; decreases casual and fasting insulinemia; (Completo et al., 2021; Chag et al., 2020; Dieli-Conwright et al., 2019; Viskochil et al., 2020);
- Increases VO2peak; increases body endurance, quality of life; decreases fatigue and body weight; decreases total mortality by 50%, breast cancer mortality by 46%, and cancer recurrence by 42% (Cenil et al., 2019; Viskochil et al., 2020; Jung et al., 2020).

REFERENCES

Brown, J. C., et al. (2022). The effects of exercise and diet on sex steroids in breast cancer survivors. Endocrine-Related Cancer, 29(8), 431–441. https://doi.org/10.1530/ERC-22-0084

Cenik, F., Keilani, M., Galid, A., & Crevenna, R. (2019). First exercise group for Turkish breast cancer patients in Vienna – A pilot project to include Turkish migrants. Disability and Rehabilitation, 41(16), 1891–1896. https://doi.org/10.1080/09638288.2018.1514666

Chang, J. S., Kim, T. H., et al. (2020). Exercise intervention lowers aberrant serum WISP-1 levels in breast cancer survivors. Scientific Reports, 10, 10898. https://doi.org/10.1038/s41598-020-67794-w

Dieli-Conwright, C. M., Sweeney, F. C., et al. (2020). Hispanic ethnicity as a moderator of the effects of aerobic and resistance exercise in survivors of breast cancer. Cancer, 126(6), 1313–1320. https://doi.org/10.1002/cncr.31879

Donato, H., & Donato, M. (2019). Etapas na condução de uma revisão sistemática. Acta Médica Portuguesa, 32(3), 227–235.

Galvão, D. A., Taaffe, D. R., Hayne, D., et al. (2022). Weight loss for overweight and obese patients with prostate cancer: A study protocol of a randomised trial comparing clinic-based versus telehealth delivered EXercise and nutrition intervention (the TelEX trial). BMJ Open, 12(6), e058899. https://doi.org/10.1136/bmjopen-2021-058899

Guercio, B. J., et al. (2019). Associations of physical activity with survival and progression in metastatic colorectal cancer: Results from Cancer and Leukemia Group B (Alliance)/SWOG 80405. Journal of Clinical Oncology, 37(29), 2620–2631. https://doi.org/10.1200/JCO.19.01019

Hughes, S., Egger, S., Carle, C., Smith, D. P., Chambers, S., Kahn, C., et al. (2019). Factors associated with the use of diet and the use of exercise for prostate cancer by long-term survivors. PLoS ONE, 14(10), e0223407. https://doi.org/10.1371/journal.pone.0223407

Jung, A. Y., Behrens, S., Schmidt, M., Thoene, K., Obi, N., Hüsing, A., Benner, A., Steindorf, K., & Chang-Claude, J. (2019). Pre- to postdiagnosis leisure-time physical activity and prognosis in postmenopausal breast cancer survivors. Breast Cancer Research, 21(1), 117. https://doi.org/10.1186/s13058-019-1206-0

Kompleto, K., et al. (2021). Using isotemporal analyses to examine the relationships between physical activity and health outcomes in breast cancer survivors. Journal of Physical Activity and Health, 18(9), 1036–1043. https://doi.org/10.1123/jpah.2019-0037

McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., & Mulrow, C. D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71

Meyerhardt, J. A., Heseltine, D., Niedzwiecki, D., et al. (2006). Impact of physical activity on cancer recurrence and survival in patients with stage III colon cancer: Findings from CALGB 89803. Journal of Clinical Oncology, 24(22), 3535–3541. https://doi.org/10.1200/JCO.2006.06.0863

Ministério da Saúde (BR). (2012). Diretrizes metodológicas: Elaboração de revisão sistemática e metanálise de ensaios clínicos randomizados. Brasília, Brazil: Secretaria de Ciência, Tecnologia e Insumos Estratégicos, Departamento de Ciência e Tecnologia.

Ministério da Saúde (BR). (2022). Sobrepeso e obesidade como problemas de saúde pública. https://www.gov.br/saude/pt-br/assuntos/saude-brasil/eu-quero-ter-peso-saudavel/noticias/2022/sobrepeso-e-obesidade-como-problemas-de-saude-publica

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2015). Principais itens para relatar revisões sistemáticas e meta-análises: A recomendação PRISMA (T. F. Galvão & T. S. A. Pansani, Trans.). Epidemiologia e Serviços de Saúde, 24(2), 335–342.

Onuchic, A. C., & Chammas, R. (2010). Câncer e o microambiente tumoral. Revista de Medicina (São Paulo), 89(1), 21–23.

Organização Pan-Americana da Saúde. (2024). Carga global de câncer aumenta em meio à crescente necessidade de serviços. https://www.paho.org/pt/noticias/1-2-2024-carga-global-cancer-aumenta-em-meio-crescente-necessidade-servicos

Orange, S. T., Jordan, A. R., Odell, A., Kavanagh, O., Hicks, K. M., Eaglen, T., Todryk, S., & Saxton, J. M. (2022). Acute aerobic exercise-conditioned serum reduces colon cancer cell proliferation in vitro through interleukin-6-induced regulation of DNA damage. International Journal of Cancer, 151(2), 265–274. https://doi.org/10.1002/ijc.33982

Patel, A. V., Friedenreich, C. M., Moore, S. C., et al. (2019). American College of Sports Medicine roundtable report on physical activity, sedentary behavior, and cancer prevention and control. Medicine & Science in Sports & Exercise, 51(11), 2391–2402. https://doi.org/10.1249/MSS.0000000000002117

Schmid, D., & Leitzmann, M. F. (2014). Association between physical activity and mortality among breast cancer and colorectal cancer survivors: A systematic review and meta-analysis. Annals of Oncology, 25(7), 1293–1311. https://doi.org/10.1093/annonc/mdu012

Schwappacher, R., Schink, K., Sologub, S., et al. (2020). Physical activity and advanced cancer: Evidence of exercise-sensitive genes regulating prostate cancer cell proliferation and apoptosis. The Journal of Physiology, 598(17), 3505–3520. https://doi.org/10.1113/JP279150

Viskochil, R., Blankenship, J. M., Makari-Judson, G., et al. (2020). Metrics of diabetes risk are only minimally improved by exercise training in postmenopausal breast cancer survivors. Journal of Clinical Endocrinology & Metabolism, 105(5), e1744–e1752. https://doi.org/10.1210/clinem/dgaa073

World Cancer Research Fund/American Institute for Cancer Research. (2018). Physical activity and the risk of cancer. Continuous Update Project Expert Report. https://www.wcrf.org/dietandcancer