PHYSICAL ACTIVITY, EXERCISE AND CANCER

Volume 1
Issue 2
July 2024

EDITED & PUBLISHED BY

KINETIC PERFORMANCE

PHYSICAL ACTIVITY, EXERCISE AND CANCER

REVIEW ARTICLE

Relationship between physical exercise load and return-to-work in female breast cancer survivors: Systematic review

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ABSTRACT

Introduction: Evidence has shown physical exercise leads health benefits in breast cancer survivors, for example reducing return-to-work (RTW) time. However, what exercise component has (if any) the greatest impact on the recovery time after breast cancer. The aim of this study is to determine the exercise load variables (type, frequency, intensity, exercise time, volume, density and progression) that are best associated with recovery time in female breast cancer survivors (measured as time off work). Methods: In this systematic review, we included experimental, cohort, and observational studies of female breast cancer survivors engaging in physical exercise programs. We searched PubMed, Web of Science, Sport Discus, and Scopus (Sep 2021-Sep 2022) using the PICOS strategy and PRISMA 2020 guidelines. Studies were independently screened and data extracted into a database, focusing on exercise variables association with return-to-work time. Methodological quality was assessed using ROB 2.0, considering study design, intervention details, and bias risk. Results: Following screening, seven studies were included in this review, with five defining a minimum of one exercise component. Two studies specified frequency and density, while three defined the type, frequency, volume, intensity, density, and progression of interventions. No study found a direct correlation between exercise components and RTW time. Conclusions: In the literature reviewed in this systematic review, it is not possible to identify which exercise variable(s) have the strongest correlation with RTW outcomes. The existing studies demonstrate a lack of comprehensive intervention descriptions, limiting our understanding of the distinct exercise components and their potential effects on RTW results.

Keywords: Fitness, Breast neoplasms, Recovery time, Rehabilitation, Employment.

Cite this article as:
Carrión Gilabert, H., Arbós Figueras, J., Matas, S., Planas Anzano, A., & Mas-Alòs, S. (2024). Relationship between physical exercise load and return-to-work in female breast cancer survivors: Systematic review. *Physical Activity, Exercise and Cancer*, *1*(2), 35-46. https://doi.org/10.61486/MYEO2515

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Submitted for publication December 26, 2023.
Accepted for publication March 05, 2024.
Published March 19, 2024.
Physical Activity, Exercise and Cancer.

Identifier: https://doi.org/10.61486/MYEO2515

INTRODUCTION

Breast cancer is the most common type of cancer, with more than 2.2 million cases in 2020 worldwide (Wild CP, 2020). About 685,000 women died of breast cancer and it is estimated that approximately one in 12 women will develop breast cancer in her lifetime (Wild CP, 2020). Scientific evidence has shown that physical activity in the form of exercise (i.e., regular physical activity that is structured, planned with the aim to improve or maintain physical fitness) (Caspersen et al., 1985; Magal & Scheinowitz, 2018) has many positive effects on both the prevention and treatment of breast cancer (Baumann et al., 2018; Irwin, 2009; Lahart et al., 2018). Many of these improvements directly affect health-related physical fitness such as improved strength, endurance and flexibility (Magal & Scheinowitz, 2018). Other relevant benefits of regular exercising include reducing the likelihood of lymphoedema (Baumann et al., 2018; Di Blasio et al., 2016), improving sleep quality (Bicego et al., 2009; Matthews et al., 2018; Savard et al., 2011), improving quality of life (Herrero et al., 2007) and improving self-esteem (Juvet et al., 2017).

The dose-response effects of exercising vary according to the type of training. For instance, regular strength training, which includes weightlifting, elastic resistance exercises, or bodyweight activities, consistently leads to improvements in body composition by increasing muscle mass and reducing body fat (Ramírez-Vélez et al., 2020). Also, when exercising at moderate or high intensity, additional benefits are observed such as improved bone density, resulting in a reduced risk of osteoporosis and fractures (Hurst et al., 2022). Similar principles apply to aerobic training, where the intensity and duration of exercises significantly impact the achieved results. For instance, comparing moderate-intensity continuous training with high-intensity interval training reveals distinct outcomes, with high-intensity interval training proving particularly effective in increasing VO_{2peak} and enhancing cardiovascular fitness when compared to moderate-intensity continuous training (SCHOENFELD et al., 2019). Moreover, within high-intensity aerobic training, variations in exercise density, such as intervals or repetitions, can lead to different results, such as variations in glucose response time or cortisol concentration (both higher after high-intensity interval exercise) (Androulakis-Korakakis et al., 2020). Not only the type of exercising, but also other components are relevant to achieve specific health outcomes. The volume of a training session (e.g., duration or sets and repetitions) significantly impacts the outcomes. Higher volumes lead to greater muscular adaptations, improvements in cardiovascular capacity and aerobic endurance, as well as increased fat loss (SCHOENFELD et al., 2019). Nevertheless, individuals new to exercise programs may benefit from a lower training volume initially to establish a foundation of fitness and allow for adaptation (Androulakis-Korakakis et al., 2020). The frequency of exercising training, which refers to the number of training sessions within a given time period, directly impacts session volume, recovery time, and physiological adaptations. For instance, higher training frequency has been observed to have a significant impact on muscle hypertrophy, leading to greater muscular gains compared to lower frequency training (Schoenfeld et al., 2016). Achieving the same physiological outcomes is unlikely when comparing two days of training per week to four days per week, even if the total workload is equivalent (Dalager et al., 2015). Managing and implementing a gradual increase in training load (i.e., the combination of volume and intensity) and difficulty over time is essential for effective progression (Escriche-Escuder et al., 2020). A good progression comprises a control on the increase of training load, allowing the body to adapt gradually to new demands. Conversely, poor progression can overload the system and heighten the risk of injury (Impellizzeri et al., 2020). Individualization remains a crucial aspect in designing a successful exercise program, accounting for personal capabilities and limitations. By considering these factors and tailoring exercise program accordingly, individuals can maximize their potential for achieving desired health outcomes and minimize the risk of setbacks or injuries (Heredia-Elvar et al., 2007).

The specific components of exercise interventions in breast cancer are scarcely described in the studies (specific dose-response), therefore, what component has (if any) the greatest impact on the recovery time after being diagnosed with a breast cancer. The components of the external exercise load are: exercise type, frequency, volume, intensity and density (Ferguson, 2014). The aim of this study is to determine the exercise load variables (type, frequency, intensity, exercise time, volume and progression) that are best associated with recovery time in female breast cancer survivors (measured as time off work prior to return-to-work).

The hypothesis of this study is that the current evidence relating exercise as an independent variable to return-to-work time is inconclusive.

METHODS

Design

This systematic review, conducted in accordance with the PRISMA 2020 guidelines (Page et al., 2021) and registered in the International Prospective Register of Systematic Reviews (PROSPERO) in September 2022 (registration number: CRD42022302738), aimed to determine which exercise load variables are most closely associated with return-to-work time in female breast cancer survivors. The search strategy employed the PICOS framework (Santos et al., 2007) with adaptations in the final equation formatting tailored to each database.

Search strategy

A comprehensive literature search was conducted in electronic databases including PubMed, Web of Science, Sport Discus, and Scopus, spanning from September 2021 to September 2022. Additionally, the search extended to tracing the references of the included literature to ensure a thorough exploration of relevant studies.

Inclusion and exclusion criteria

Studies meeting the following criteria were considered for this review: experimental, cohort and observational studies; the population included female breast cancer survivors over 18 years of age; and participants in supervised or home-based physical exercise programmes. Interventions that did not differentiate by cancer type, that included participants with metastases, or that included participants who were still on sick leave at the time of data collection were excluded so that it does not conflict with measuring total duration of sick leave as an outcome.

Data extraction

All abstracts identified following the search strategy were imported into the Mendeley bibliographic manager. The primary outcomes of this review were sample size (n); study design; definition of the intervention performed; quantified loading component (frequency, intensity, time, exercise, volume and/or progression); temporality of testing and time off work (TBL) (day count) or return-to-work (RTW) (day count).

Data evaluation

Two authors (HCG) and (JAF) independently screened the studies by title and abstract. In case of discrepancy between authors, studies were selected from their full text. The selected articles were retrieved and the same two authors reviewed each study on a full-text basis. Discrepancies at this stage were resolved by two other reviewers (SMA and APA). The authors (HCG and JAF) independently extracted the results of each study in a MS Excel ® spreadsheet software. They were merged and discrepancies between the two extractions were resolved by the whole team.

Methodological quality was assessed using the ROB 2.0 tool for randomised studies (Higgins et al., 2019). The elements assessed were: intervention time period, groups, dropouts, physical capacities mainly developed in the intervention, intervention definition, age, participants and study design. Responses were then scored with five points. 1 for "*yes*", 2 for "*probably yes*", 3 for "*probably no*", 4 for "*no*" and 5 for "*no information*". Finally, the tool's algorithm was used which categorises the study by: "*low risk of bias*", "*some concerns*" or "*high risk of bias*". Quality assessment was performed by one author (HCG) and queries were resolved by the whole team.

RESULTS

The flow chart (PRISMA) shown in Figure 1, shows the identification of 763 records during the initial search of the PubMed, Web of Science, Sport Discus and Scopus databases. Eight more records were added, identified by serendipity. Titles and abstracts were read and a total of 372 were discarded as they did not meet the inclusion criteria. The remaining 78 articles were suitable for full-text reading. Finally, a total of seven studies were eligible for this review (see Table 1) (Berglund et al., 1994; Björneklett et al., 2013; Bolam et al., 2019; Jong et al., 2018; Mijwel et al., 2019; Rogers et al., 2009; Van Waart et al., 2015). All included studies were experimental, none of them followed a cohort or observational design.

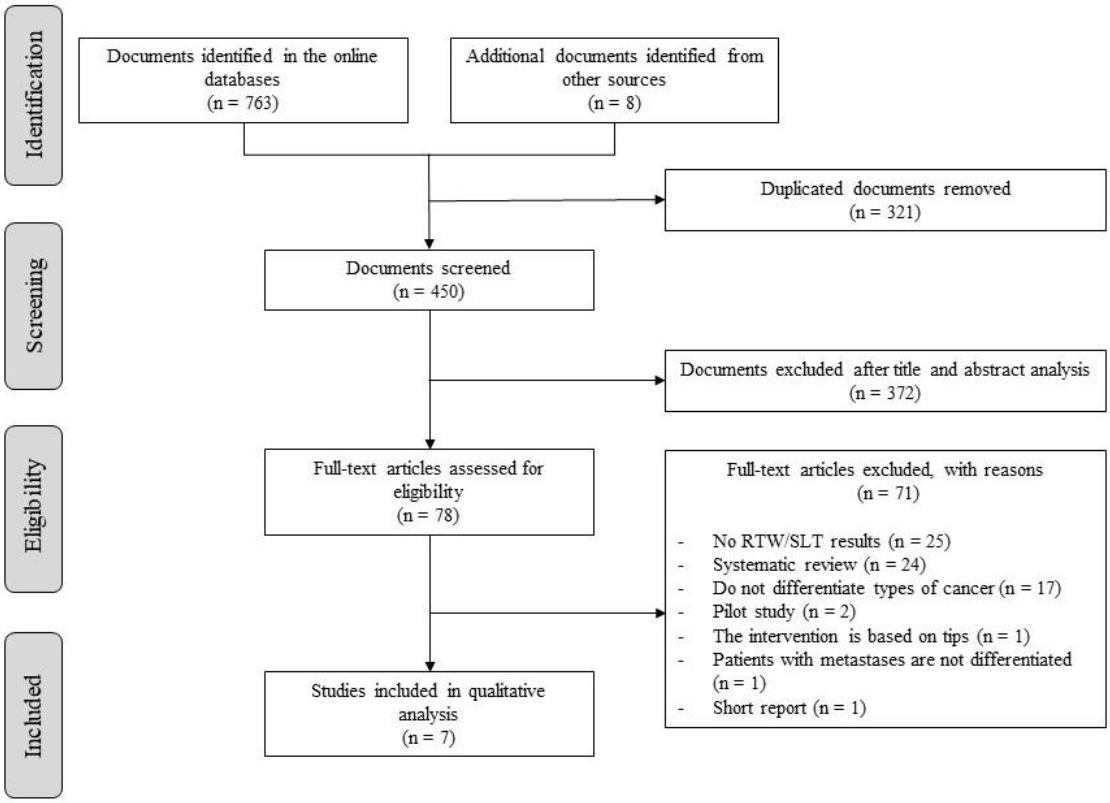

Figure 1. Flow chart.

To facilitate the analysis and reading of the results, the numbers of the studies correspond to the number appearing in the tables of this study: Studies 2, 4 and 5 show a difference between the number of participants in the intervention and control groups that may affect the results, that is, Study 2 (control n = 27, intervention group n = 40) Study 4 (control n = 52, intervention group 1 n = 62, intervention group 2 n = 59) Study 5

(control n = 48, intervention group 1 n = 58, intervention group 2 n = >54). Using the RoB 2.0 tool (Table 2) these studies were rated with "*some concerns*". Study 6 shows a result using an index that was not described in the study, consequently it could not be identified and was rated as "*high risk*". However, it was decided to keep it in this review because it met all inclusion criteria.

Table 1. Characteristics of the studies added.

Nº	Study	Population	Design	Intervention	Exercise-load component defined	Outcome	Physical exercise definition
1	Björneklett et al., 2013	382	RCT	Physical exercise intervention	None	SLT	No
				Control	None		
2	Jong et al., 2018	83	RCT	Physical exercise intervention	Frequency Density	RTW	Partially
				Control	None		
3	Van Waart et al., 2015	230	RCT	Physical exercise recommendation	None	RTW	Yes
				Physical exercise intervention	All*		
				Control	None		
4	Mijwel et al., 2019	240	RCT	Physical exercise intervention (1)	All*	RTW	Yes
				Physical exercise intervention (2)	All*		
				Control	None		
5	Bolam et al., 2019	240	RCT	Physical exercise intervention (1)	All*	RTW	Yes
				Physical exercise intervention (2)	All*		
				Control	None		
6	Rogers et al., 2009	41	RCT	Physical exercise intervention	None	RTW	No
				Control	None		
7	Berglund et al., 1994	25	RCT	Physical exercise intervention	Volume Frequency	SLT	Partially
				Control	None		

*Note. RCT: Randomized Controlled Trial. RTW: Return-To-Work. SLT: Sick Leave Time. *All: exercise name, frequency, volume, intensity, density, individualisation and progression.*

Table 2. Risk of Bias.

		D1	D2	D3	D4	D5	Overall
1	Björneklett et al., 2013	+	+	+	+	+	+
2	Jong et al., 2018	!	+	+	+	+	!
3	Van Waart et al., 2015	+	+	+	+	+	+
4	Mijwel et al., 2019	!	+	+	+	+	!
5	Bolam et al., 2019	!	+	+	+	+	+
6	Rogers et al., 2009	+	+	+	-	+	-
7	Berglund et al., 1994	+	+	+	+	+	+

Note. D1: Randomisation process. D2: Deviations from the intended interventions. D3: Missing outcome data. D4 Measurement of the outcome. D5: Selection of the reported result. +, Low risk. !, Some concerns. -, High risk.

Table 3 shows the results obtained by the studies ordered by test timing as well as statistical significance. By regards of the quantification of burden five out of the seven studies (Studies 2, 3, 4, 5 and 7), define a

minimum of one component of the exercise load. Of those five, two studies (2, 7) include the frequency and density of exercising. These studies quantify how many training sessions and how they were distributed during the intervention period, but do not define what type of exercise they performed or any of other workload components. Finally, three out of seven studies (3, 4 and 5) define all components of the exercise: exercise name, frequency, volume, intensity, density, individualisation and progression. Three experimental studies (studies 2, 3, 4) show a higher percentage of patients returning to work earlier in the intervention group compared to the control group. In contrast, the control group shows better results in one study (1), two studies (5, 7) show the same results in the intervention group compared to the control group.

Table 3. Results of added studies.

Nº	Study	Group	Initial status	Post-Int	2 Months	3 Months	6 Months	12 Months	24 Months	*p**
1	Björneklett et al., 2013	Exercise	64.5% BL		44.3% BL		36.2% BL	35.6% BL		No
		Control	63.7% BL		45.7% BL		32.6% BL	27.1% BL		
2	Jong et al., 2018	Exercise	84% W			29% W	53% W			NS
		Control	72% W			27% W	23% W			
3	Van Waart et al., 2015	Recommendation	66% W	34% W			83% W			Yes
		Exercise	70% W	40% W			79 % W			
		Control	70% W	15% W			61% W			
4	Mijwel et al., 2019	Exercise (1)	NS					82% W		Yes
		Exercise (2)	NS					91% W		
		Control	NS					59% W		
5	Bolam et al., 2019	Exercise (1)	NS						86% W	No
		Exercise (2)	NS						89% W	
		Control	NS						89% W	
6	Rogers et al., 2009	Exercise	NS			[a]				No
		Control	NS			[a]				
7	Berglund et al., 1994	Exercise	70% BL	20% BL				11% BL		No
		Control	56% BL	20% BL				11% BL		

Note. BL: Percentage of participants on sick leave. W: Percentage of participants working. p: Statistical significance. [a]: Not stated. No: Statically non-significant differences. [a] In the study by Rogers L, et al. (2019) an unknown index is used to present the results.

Two studies showed statistically significant results (3 and 4), four did not obtain statistically significant results (1, 5, 6 and 7) and the study 2 does not include statistical significance.

DISCUSSION

Among the 450 studies encompassing the correlation between physical exercise and return to work (RTW) for breast cancer survivors, none of them specifically pointed out the relationship of exercise components on RTW outcomes independently. This study highlights a common misconception about physical exercise interventions. For example, defining the intervention in terms such as "*12 individual supervised exercise days*" (Rogers et al., 2009) or "*weekly sessions of 75min at the hospital over a period of 12 weeks*" (Jong et al., 2018) or simply "*physical exercise*" (Björneklett et al., 2013) may not be enough to understand what specificity of exercising is related to observed health outcomes. Defining better the exercise load (dose) to

better understand the effects (response) of exercise programmes in breast cancer patients may optimise their recovery and return-to-work. In the case of "*walking some days a week*", monitoring may include the intensity of the exercise (walking speed), the volume (distance or time), the rests (density), the geographical characteristics of the route (mental and social health) and, if necessary, the mode of individualisation and the progression of this exercise dose. It follows the traditional principles of exercise training: the principle of overload and adaptation, repetition and periodisation, progression of the load, optimisation between load and recovery, functional unity, specificity, variability, reversibility and individualisation (González-Peris M et al., 2022); and the principle of the reproducibility of the scientific method (Goodman et al., 2016). It might be relevant to describe the muscle groups involved in muscle-strengthening exercise, sets and repetitions (volume), the rhythm of work (intensity) and rest, and the criteria under which the individual load or progression is individualised.

Previous systematic reviews observed positive results on exercising to reduce return-to-work in cancer populations (Algeo et al., 2021; Schutz et al., 2021; Tamminga et al., 2010; Wilson et al., 2023). Their invaluable contribution serves as a pivotal foundation for developing an effective post-operative recovery plan. Nonetheless, without acknowledging the significance of each aspect of the training load in relation to return-to-work, we will fall short of fully optimizing the recovery process. Also, only three studies out of the 450 included in this review, detail specific components of the exercise group (Bolam et al., 2019; Mijwel et al., 2019; Van Waart et al., 2015). In other words, only three interventions may be replicated according with the information provided.

In the Consensus Statement from International Multidisciplinary Roundtable of 2019, it became clear that most of the research conducted to date does not (Campbell et al., 2019) take into account the principles of training and that the conclusions they show come from secondary results. Several exercise prescription guidelines for different pathologies exist, such as those of the ACSM (Ferguson, 2014), the articles by Pedersen and Saltin (Pedersen & Saltin, 2015), FYSS (Borjesson & Sundberg, 2013) or PEFS (González-Peris M et al., 2022). But some exercise components relevant for expected health outcomes for oncology patients are still missing.

This information gap confirms the hypothesis initially put forward, which anticipated the lack of detail in physical exercise intervention. This opens up a new line of research. This includes cost-effectiveness of the interventions (from the point of view of the patient, but also of public health institutions), optimisation of workloads for this group, the impact on the perception of the quality of life of this population according to the type of training carried out, among others. The high incidence and the high economic cost of this disease, both for patients and for the public health system, are factors that must be taken into account in addition to its mortality rate. The economic cost of cancer worldwide is unknown, but in 2017, the economic burden due to lost productivity was approximately 30 billion dollars in China and the United States and 10.5 billion euros (11 billion dollars) in the European Union (The American Cancer Society, 2019).

Exercise interventions for people with breast cancer should distinguish the participant's previous characteristics as well as their subsequent work demands. The key to good training progression is individualisation. And indicators such as the type of previous work, their physical requirements or the physical affectations that arose as a consequence of their oncological treatment are necessary to set goals and timing. These studies should also take into account previous and subsequent working hours, as working half a day is not the same as working full time. It would also be interesting to know which are the most limiting factors that postpone the return-to-work. Perhaps the optimal physical exercise prescription for this group depends more on their individual needs than on the normal values for each physical capacity.

CONCLUSIONS

The scarcity of studies focusing on the correlation between physical exercise components and return-to-work outcomes among female breast cancer survivors underscores a significant research gap in this field. The existing studies often fall short in providing comprehensive descriptions of the interventions implemented, which limits our understanding of the specific exercise protocols and their potential effects on return-to-work outcomes. Moreover, a noteworthy challenge lies in the presentation of return-to-work results as secondary data, which hampers the accurate interpretation of statistical indices. By relying on secondary data, researchers may miss crucial nuances and contextual factors that could influence the relationship between physical exercise and successful reintegration into the workforce.

Furthermore, an additional limitation is the failure of many studies to specify the initial employment status of participants and their intentions regarding returning to work. This omission overlooks essential factors that could contribute to the decision-making process and the overall success of returning to work post-treatment. It is plausible that some individuals choose not to re-enter the workforce due to personal preferences, emotional considerations, or various reasons not accounted for in the current body of research. Understanding these individual circumstances and motivations is crucial for developing tailored interventions and support systems that address the unique challenges faced by breast cancer survivors in resuming work.

To bridge these gaps in knowledge, future research efforts should aim to conduct more investigations that elucidate the specific relationship between physical exercise and return-to-work outcomes among female breast cancer survivors. These studies should include detailed descriptions of interventions, collect primary data on employment status and intentions, and incorporate qualitative approaches to capture the multifaceted factors influencing individuals' decisions regarding returning to work. By addressing these limitations and filling the existing research void, we can gain a more comprehensive understanding of how physical exercise can effectively support breast cancer survivors in achieving successful reintegration into the workforce.

AUTHOR CONTRIBUTIONS

Hector Carrión Gilabert was responsible for the project's methodology, formal analysis, data curation, and initial writing. Judith Arbós Figueras handled data curation. Sergi Matas contributed to the methodology, provided resources, and ensured validation. Antoni Planas Anzano focused on data visualization and managed the project, also reviewing and editing the manuscript. Sebastià Mas Alòs conceptualized the project, validated findings, and supervised the project, also reviewing and editing the manuscript.

SUPPORTING AGENCIES

Funding has been received from PINEFC AGAUR (PRE/2835/2020). The funders had no role in considering the study design or in the collection, analysis, interpretation of data, writing of the report, or decision to submit the article for publication.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author.

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PHYSICAL ACTIVITY, EXERCISE AND CANCER

ORIGINAL ARTICLE

A new interdisciplinary approach for oncological patients: Complementary treatments, isolated or combined intervention?

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ABSTRACT

Cancer patients suffer a clear decrease in their quality of life due to the numerous side effects and sequels produced by the treatments and the disease itself. Scientific evidence confirms that work with physical exercise, physiotherapy, nutrition and psychology provide numerous benefits for these patients. At the UAPO Foundation we address these areas in an interdisciplinary manner, uniting these treatments that are normally given in isolation. In this way it could be verified whether people who have or have had cancer obtain a higher quality of life with our work. Physical exercise is the main axis with a frequency of two 60-minute sessions per week accompanied by nutritional, psychological and physiotherapeutic assistance.

Keywords: Physical exercise, Cancer, Nutrition, Physiotherapy, Psychology, Quality of life.

Cite this article as:
Galán Sáenz, R., Issa-Khozouz Santamaría, P., Torices Caballero, M., Barroso Prieto, T., Maroto Milena, C., Castellanos Dafos, M., Garrido González, D., González Fernández, A. I., Morales García, J. M., Torrú Moreno, F., Aroca Millas, C., Guardia Asensio, M., Mazo Da Silva, A., Cánovas Pérez de la Blanca, J., & Álvarez Campos, A. (2024). A new interdisciplinary approach for oncological patients: Complementary treatments, isolated or combined intervention?. *Physical Activity, Exercise and Cancer*, *1*(2), 47-52. https://doi.org/10.55860/UWRT1632

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Submitted for publication March 01, 2024.
Accepted for publication April 17, 2024.
Published July 08, 2024.
Physical Activity, Exercise and Cancer.

Identifier: https://doi.org/10.55860/UWRT1632

INTRODUCTION

According to calculations by REDECAN (Spanish Network of Cancer Registries), in 2024, there will be an estimated 286,664 new cases of cancer in our country. The majority of these cases will suffer a decrease in their quality of life due to the numerous side effects and sequels produced by oncological treatments (Spanish Society of Medical Oncology (SEOM), 2024, p.7).

The UAPO Foundation was created with the aim of improving the quality of life of patients who have or have had cancer through adjuvant treatment and consists of four areas: psychology, nutrition, physiotherapy and physical exercise. Clear evidence shows that working these areas independently improves the quality of life of cancer patients and tolerance to the side effects of treatments.

Knowing that patients can benefit from these complementary treatments, this unit tries to answer whether a holistic approach to these areas would obtain better results than if they were treated individually. If it is shown that, indeed, the benefit is greater, one could even hypothesize whether this would mean a reduction in public health costs.

MATERIAL AND METHODS

The UAPO methodology treats each patient within the four areas seeking to achieve the following objectives:

Main objective: Improve the quality of life of cancer patients.

Secondary objectives:

- Improve the patient's physical condition.
- Improve any sequels or injuries caused by the treatments.
- Increase patients' autonomy in their daily living activities.
- Improve body composition, prioritizing the improvement of muscle mass.
- Evaluate if there is an improvement in emotional management.

Participants: inclusion/exclusion criteria

Currently at the UAPO Foundation, more than four hundred patients with different cancer diagnoses are being treated in an interdisciplinary manner, in our four areas (breast 49.2%; colon 8.2%; prostate 6%; lung 5.4%; ovarian 5%; kidney 3.7%; myeloma 3.7%; lymphoma 3.7%; stomach 2.5%, brain 2.5%; others 10.1%). To access treatment from the UAPO foundation, patients must meet the inclusion criteria (see Table 1).

Table 1. Inclusion criteria.

Inclusion criteria
Patients with a minimum age of 4 years.
Participants with a diagnosis of any type of malignant cancer.
Participants in any phase of treatment. From the survival phase to a maximum of one year after completing treatment.
Participants with physical sequels derived from oncological treatments.
Be able to understand the instructions, programs and protocols of the study
Signing of an informed consent.

INTERVENTION

The intervention in the unit begins with a mandatory initial assessment that consists of:

Anamnesis

Initial interview detailing disease status, treatments received before and currently, non-oncological medication, sequels secondary to treatments, injuries and/or diseases prior to the oncological process. Injuries and/or sequels are measured through: joint assessment (goniometry), muscle assessment (Daniel's test), lymphedema (circometry), cardiotoxicity (medical report), scar status (Vancouver scale), pelvic floor dysfunctions (scheme). PERFECT and modified OXFORD scale).

Physical condition assessment

Different tests are carried out in which it is assessed; dynamic balance (Y balance test); manual grip strength (Hand grip); functionality (Sitting Rising test); the strength and power of the lower body (Sit to stand 5 times test); upper body strength and power (10RM bench press), recovery capacity (Ruffier Test) and cardiorespiratory and functional capacity (Six-minute walk test)

Nutritional assessment

Based on 24-hour food recall, food consumption frequency questionnaire, assessment of nutritional status through Subjective Global Assessment, and body assessment through electromagnetic bioimpedance and anthropometric measurements based on the ISAK protocol.

Psychological assessment

Through questionnaires, of anxiety levels (BAI. Beck Anxiety Inventory), symptoms of depression (BDI II. Beck Depression Inventory), self-esteem levels (RSE. Rosenberg Self-Esteem Scale) and general health status and quality of life (SF-36, version 2).

After the initial assessment, a physical exercise intervention group is assigned that will consist of two weekly sessions of concurrent strength and cardiorespiratory training lasting 60 minutes divided into warm-up, main part and cool-down. Each patient works in groups of a maximum of 4 people, although each case will be treated individually.

In the area of physiotherapy we can differentiate two forms of work:

- -Treatment in consultation. These sessions, assigned at the discretion of the physiotherapist, are individualized and last 50 minutes.
- -Rehabilitation treatment/therapeutic exercise. Its frequency is two weekly sessions with a maximum of two patients per group and they last 60 minutes.

In the areas of nutrition and psychology, the interventions are assigned depending on the responsible professional with a duration of 60 to 90 minutes.

JUSTIFICATION

Scientific evidence supports the benefits that the different work areas of the unit can have on cancer patients.

An adequate psychological intervention that facilitates emotional management positively benefits both the oncological process and the adaptation to the effects of the treatments. Various psychological factors, such

as the response to stress, can generate biological and behavioural changes in the face of the disease. Certain personality traits and coping styles influence the patient's quality of life (J.P. Arbizu et al., 2009).

During cancer, the patient's nutritional status may be affected. Conditions such as cachexia, sarcopenia, obesity or osteoporosis are highly prevalent in this population, negatively impacting treatment tolerance, hospital stay, post-surgical recovery, physical capacity, and the patient's quality and life expectancy. In turn, due to the amount of contradictory information about diet and cancer, patients feel confused, which increases the risk of suffering from eating behaviours that are detrimental to the prognosis of the disease and their psychosocial health. (Arends et al., 2017; Prado et al., 2021; Ford et al., 2022).

Physical exercise has been shown as an effective tool for cancer prevention and as another treatment, during and after the disease. Strength, muscle mass and cardiorespiratory capacity have proven effective in improving quality of life, tolerance to treatments and their effectiveness, as well as alleviating the side effects derived from them (Schmitz, 2020).

There are many reasons why strength training will help preserve health, since first of all, cancer survivors who are physically active and incorporate a day of strength training have a 33% lower risk of death (Hardee et al., 2014).

Based on this, it is crucial to emphasize not only muscle mass, but also the good function of the muscle itself, since, without good functionality, the fact of having muscle mass is not protective in itself. (Newman et al., 2006).

Physiotherapy is a key piece before, during the course, and after the completion of cancer-related treatments. Pre-rehabilitation is basic and has been proven effective in improving the quality of life of these patients during treatments, improving mobility, elasticity and muscle strength. During the medical process, physiotherapy focuses on the treatment of symptoms and sequels caused mainly by possible surgeries, chemotherapy, radiotherapy, etc., using different techniques (Cancer Prehabilitation Programs and Their Effects on Quality of Life, 2018).

Mcleod et al., 2019 saw how the quality of life and the completion rate of therapies seem to be higher in people who have greater muscle mass or include strength training during the disease. Furthermore, it has been seen that preserving muscle mass can be a good prognostic indicator for an adequate response to certain drugs (Shiroyama et al. 2019).

In conclusion, the UAPO Foundation seeks to answer whether interdisciplinary treatment is more effective than individualized treatment for patients who have or have had cancer.

AUTHOR CONTRIBUTIONS

Margarita Torices, Paloma Issa-Khozouz and Raquel Galán are the main authors of the article. Tania Barroso is the author of the section "*Psychological Assessment*" and the psychologist in charge of carrying out this assessment in the Unit. Arancha Mazo is the author of the section "*Nutritional Assessment*" and the nutritionist in charge of carrying out this assessment in the Unit. Celia Aroca, Cristina Maroto, Francisco Torrú, José Manuel Morales and David Garrido are the physical educators of the unit who contribute to the multidisciplinary work. Ana Isabel Gonzalez, Marta Guardia, Miguel Castellanos and Alfonso Álvarez are the

unit's physiotherapists who contribute to the multidisciplinary work. Javier Cánovas is the General Manager of the Unit.

SUPPORTING AGENCIES

No funding agencies were reported by the authors.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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PHYSICAL ACTIVITY, EXERCISE AND CANCER

ORIGINAL ARTICLE

The Outdoor Against Cancer Connects Us (OACCUs) Project: A European initiative promoting healthy lifestyle among young cancer survivors

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ABSTRACT

Objective: The main project objectives will be to characterize the lifestyle behaviours of young cancer survivors (YCS) and to examine the associations of physical activity, balanced nutrition and sustainability and nature behaviours with mental well-being and quality of life. Methods: The present cross-sectional project will include YCS between 15 to 39 years from Germany, Greece, Italy, Portugal, Spain, and Sweden. Sociodemographic aspects and disease history will be collected. The International Physical Activity Questionnaire and The International Fitness Scale will be applied to assess physical activity and sedentary levels; and self-reported fitness, respectively. The questionnaire on adherence to the Mediterranean diet will evaluate healthy diet habits, and a short set of questions will cover the environmental quality of residence of the participants, as well as their outdoor habits. In addition, the EQ-5D-5L instrument will measure health-related quality of life, and the Hospital Anxiety and Depression Scale will collect depression and anxiety symptoms. Results: It is hypothesised that positive lifestyle behaviours, such as increasing physical activity and following balanced nutrition, may correlate with improved mental well-being and quality of life in YCS. These findings have the potential to deepen our understanding of the intricate interplay between cancer, lifestyle and mental health.
Keywords: Physical activity, Healthy diet, Environmental pollution, Mental health.

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Submitted for publication May 02, 2024.
Accepted for publication June 12, 2024.
Published July 08, 2024.
Physical Activity, Exercise and Cancer.

Identifier: https://doi.org/10.55860/RVJU9406

INTRODUCTION

Due to increased risk factors and improved early diagnostic methods, the worldwide incidence of cancer is rising (World Health Organization, 2024a). It is therefore expected that there will be more than 35 million new cases of cancer in the entire population by 2050, an increase of 77% from the 20 million cases in 2022 (World Health Organization, 2024a). With the current improvements in cancer treatment, the number of young cancer patients who can be defined as survivors is increasing. In 2022, there were 1,321,779 new cases of this disease reported globally among individuals aged 15-39, with 151,086 cases documented in Europe alone (World Health Organization, 2024b). This group of YCS may face several challenges specifically linked to their young age (e.g. related to school/university, vocational education and professional life, sexuality/fertility and family life, insurances, and loans) that impact their quality of life (Fox et al., 2023; Soanes & White, 2018). Therefore, from the perspective of public administration, such as the European Commission, interest and effort have been focused on supporting the study and description of the fundamental characteristics of this population group, with the intention of improving and customizing strategies to promote the enhancement of quality of life and integration into society (European Commision, 2022, 2023).

Talking about cancer survivors could generate some confusion regarding the concept, as the term "*cancer survivors*" does not have a unique definition (Marzorati et al., 2017). Here we will refer to the most widely used definition, provided by the National Cancer Institute, which sees cancer survivorship as a process that begins from the time of diagnosis and continues until the end of life (Denlinger et al., 2014). However, there are considerable differences between people living with cancer who are undergoing cancer treatment and those who have completed all treatments. Then, we could even make an additional differentiation between those being under treatment and those free of treatment.

In order to properly develop strategies to promote the enhancement of quality of life, it is necessary to describe the fundamental characteristics of YCS and then, act on potential risk factors among YCS to reduce long-term side effects and improve longevity as well as long-term quality of life (Marzorati et al., 2017). Among the modifiable risk factors, lifestyle components are those on which we can act to modify the probability of having cancer, for instance, healthy diet, smoking cessation, reducing alcohol intake, increase physical activity levels and sleep quality among others (Bull et al., 2020). Often, lifestyle changes are also targeted during and after cancer therapy in order to improve prognosis and recovery. However, it is not always easy to change lifestyles and modify population behaviours. Thus, it is of vital importance to address these behaviours that have the greatest impact on the health of cancer survivors to maximize the reduction of cancer burden and long-term consequences (Palma et al., 2022). Targeting behavioural change, which is intended "*as the extent to which a person's behaviour coincides with medical, professional or health advice*", may also be useful for higher adherence, since modifying survivors' lifestyle could be challenging (Horwitz & Horwitz, 1993).

In relation to physical activity for cancer survivors, the American College of Sports Medicine and the World Health organisation (Bull et al., 2020) suggest three sessions per week of aerobic training for 30 minutes (at moderate intensity) and two sessions per week of resistance training (at moderate intensity) but adjusted to the needs of the individual cancer survivor. Complying with these guidelines and increasing physical activity levels can prolong longevity (Bull et al., 2020). However, the literature agrees on the need to develop and implement guidelines specifically for YCS (Marzorati et al., 2017), for which becomes very relevant to better know their particular profile and characteristics. Additionally, implementing outdoor physical activity interventions may lead to extra physiological and psychological benefits and thus should be promoted for both YCS and cancer patients in general (Blaschke, 2017), especially when this outdoor physical activity is

developed in green-blue environments because the contact with nature has shown to be an added value for overall health (Rojas-Rueda et al., 2019).

On the other hand, embracing a healthy nutrition pattern should also be considered as being beneficial for longevity in YCS. The Mediterranean diet (García-Conesa et al., 2020; Martínez-González et al., 2012) is considered a valuable nutritional approach with multiple benefits allowing individuals to get older healthier. This type of diet is also considered sustainable since it builds on fresh and local seasonal food (García-Conesa et al., 2020). Promoting adherence to the Mediterranean diet in YCS can help in sustaining balanced healthy nutrition and well-being related indicators.

An emerging modifiable risk factor that has been identified today is the lack of sustainability and connection to nature, which should be integrated into our lifestyle. Particularly, concerns raised by climate change and environmental pollution not only have direct consequences on people's lives but also compromise their mental health (King et al., 2022; Rojas-Rueda et al., 2019). Daily actions, keeping in mind nature contact and its sustainability, can reduce this burden and ameliorate our emotional condition especially if impacted by severe disease.

Finally, mental and physical well-being are hence strictly related. YCS may suffer mental and psychological distress due to cancer diagnosis, pharmacological treatment (National Comprehensive Cancer Network Foundation, 2020) and associated life's changes. Physiological and psychological cancer consequences should thus be investigated together to better design future approaches to promote healthy lifestyle behaviour. Particularly, to better understand how those modifiable risk factors could interact with mental well-being and quality of life in YCS would be of great interest.

Therefore, the main objectives of the current project will be to characterize the lifestyle behaviours of YCS and to examine the associations of physical activity, outdoor sports, balanced nutrition and sustainability and nature behaviours with mental well-being and quality of life in YCS. As a secondary objective, the project aims to develop and offer a comprehensive suite of digital tools for YCS to facilitate easier access to a healthy lifestyle. Additionally, it seeks to establish a network among YCS by leveraging this project and promoting the adoption of healthier lifestyles.

METHODS

Participants and selection criteria

The present cross-sectional project includes study research conducted in the partner countries conforming to the Outdoor Against Cancer Connects Us (OACCUs) consortium (https://oac-connect.eu/), i.e. Germany, Greece, Italy, Portugal, Spain, and Sweden. Inclusion criteria, which delimit the term YCS to those being between 15 and 39 years old; having been diagnosed with cancer at any time in their life; not currently under chemotherapy; not suffering cancer relapse or a secondary tumour; not under palliative treatment/care; and be able to perform everyday activities freely and independently. Conversely, individuals presenting the following characteristics will be excluded: inability to perform everyday activities; recent cancer diagnosis, including cancer relapse and secondary tumours; undergoing primary treatment with curative intent; or diagnosed with basal cell skin carcinoma. The individuals who meet these eligibility criteria will be asked to complete the multidisciplinary questionnaire.

Data collection

In order to gain insight into the attitudes of YCS towards healthy lifestyles and into their need for support, the consortium considered it essential to establish 4 fundamental pillars Physical Activity and Outdoor Sports (Pillar 1), Balanced Nutrition (Pillar 2), Sustainability and Nature (Pillar 3), and Physical and Mental Well-being (Pillar 4). We will require YCS from the OACCUs consortium countries to complete a multidisciplinary, digital, and online questionnaire, that is called the "*OACCUs e-Questionnaire*" (https://oac-connect.eu/survey/en). The OACCUs e-Questionnaire has been developed in English and then translated into each country's language, and it will be available online through the OACCUs homepage in seven languages. Various methods will be used to engage the target group and collect input anonymously, including dissemination of the OACCUs e-Questionnaire via the project website and QR codes, direct distribution by project staff at OACCUs events, externally organised events, distribution to country-specific stakeholder groups such as patient associations and hospital data collections, as well as recruitment through population-based cancer registries.

Outcomes measures

The OACCUs e-Questionnaire included patient history plus validated questionnaires on the main 4 pillars of a healthy lifestyle on which the project is based. Therefore, the final OACCUs e-Questionnaire has 5 parts; the first includes questions on anthropometric and sociodemographic information and disease characteristics. The resting 4 sections are based on behavioural and lifestyle factors related to the 4 pillars: Physical Activity and Outdoor Sports, Balanced Nutrition, Sustainability and Nature, and Physical and Mental Well-being. Briefly, the 5 sections are partitioned as follows:

Section 1: OACCUs-specific section

This section comprises information on sociodemographic aspects, socioeconomic status, comorbidities, barriers to physical activity, sport and nutrition is asked for as well as self-reported anthropometric information such as height and weight. Moreover, cancer-related information such as date of diagnosis, diagnosis methods and hospital, types of cancer, treatment history, treatment-related effects, and follow-up care are also collected.

Section 2: Pillar 1. Physical activity, Exercise and Sport/Physical Activity and Sedentary levels

The International Physical Activity Questionnaire (Craig et al., 2003) is chosen to assess the physical activity and sedentary levels of YCS. Even if not specifically suggested for use with cancer survivors (Meh et al., 2021), this validated questionnaire has been selected since it is easy to fill in and is fully accessible. This questionnaire collects vigorous physical activity, moderate physical activity, walking activity and sitting time, ascertaining the number of days and hours per day to estimate the total physical activity in a typical week.

The International Fitness Scale (Ortega et al., 2011, 2013) is applied to assess physical fitness in a self-reported measure. It collects data on general physical fitness, strength, flexibility, agility and speed, and aerobic capacity. It is a validated questionnaire, translated into 9 languages, which has been found useful in epidemiological studies aimed at estimating fitness levels in all age groups, including adolescents and young adults (Ortega et al., 2011, 2013).

Section 3. Pillar 2. Healthy Nutrition Behaviours

The questionnaire about adherence to the Mediterranean diet is included (Martínez-González et al., 2012). This 14-item screener consists of twelve questions on food consumption frequency and two questions on food intake habits considered characteristic of the Mediterranean diet. Five of these questions are critical to an assessment of adherence to the traditional Mediterranean diet in the present population. Each question

is scored 0 or 1. The final questionnaire score ranges from 0 to 14. This questionnaire is selected due to the relevance of the Mediterranean diet for the promotion of a healthy lifestyle (García-Conesa et al., 2020). The questionnaire is also selected considering that its validity has been tested across European countries, including the majority of the countries participating in the OACCUs project (García-Conesa et al., 2020).

Section 4: Pillar 3. Healthy Environment / Nature

A short set of questions covers environmental quality and features of places, where participants use to do physical activity, sport or leisure time activities (air quality, pollution, noise, temperature, indoor/outdoor, etc). This section is designed considering the main aim of OACCUs, i.e. promoting an active outdoor lifestyle and considering the benefits that being connected with Nature may have (King et al., 2022; Rojas-Rueda et al., 2019).

Section 5: Pillar 4. Psychological well-being/ Mental Health/ Quality of life

This section consists of two sections:

i. *Health-related quality of life* is measured using the EQ-5D-5L instrument (Herdman et al., 2011). EQ-5D-5L consists of two parts: the first part evaluates the prevalence of problems in five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) obtaining an EQ-index (0-1), and the second part, the EQ visual analogue scale records self-reported health status (0-100). This questionnaire is widely used in studies of cancer populations; it provides a high discriminatory power and validity (Chai et al., 2023).
ii. *Depression and anxiety.* Information on depression and anxiety is collected using the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), which measures anxiety and depression in people with physical illnesses and has been used to assess mood in cancer patients both in clinical and research practice (Carey et al., 2012; Walker et al., 2007). This questionnaire has seven items for each anxiety and depression, with total scores ranging from 0 to 21. Items are rated on a 4-point severity scale, and each question is scored between 0 (no impairment) and 3 (severe impairment).

Sample size

It is expected to obtain a minimum of 30 and up to 100 completed questionnaires from each of the six countries which make a total of expected responses ranging from 180 to 600. This estimation will provide a comprehensive understanding of YCS that accurately reflects the general population and their characteristics. It will enable statistical analysis of cohorts, including potential sensitivity analyses based on factors such as cancer type, treatment pattern (e.g. treated with agents that increase the risk of specific toxicities), gender, time since diagnosis (> 5 year overall survival), demographics, or any other unique group relevant to the research interest.

Digital toolbox for YCS

The OACCUs project also aims to create and deliver a comprehensive set of digital tools for YCS to facilitate access to a healthy lifestyle and to establish a network among them, called "*OACCUs Network Toolbox*". It will host outreach articles based on updated scientific evidence adapted for easy understanding and applicability, learning and empowerment tools in each of the 4 pillars of OACCUs such as audio podcasts, video podcasts, infographics, interactive guides and booklets, online planners, a repository of exercise videos and exercise blocks among others. On the other hand, it will also offer a section with video testimonials from YCS ambassadors of OACCUs and other inspirational videos and a community section for interaction between YCS.

Ethical considerations

All participants will be asked to agree (by clicking online) that the data collected in the questionnaire may be used for research purposes within the framework of the European OACCUs project, knowing that the data are completely anonymous and do not identify participants personally. Participants will also confirm that they understand the questionnaire complies with the General Data Protection Regulation (GDPR) for the processing of personal data in the European Union published on 17 April 2016, repealing the former Directive 95/46/EC. Ethical approval for this project has been obtained from the ethical committee of University of Patras, Swedish Ethical Review Authority and University of Palermo.

Statistical analyses

Descriptive analyses will be performed for continuous and categorical variables. The mean, standard deviation, minimum, maximum and quartiles or percentages will be calculated for continuous and categorical variables, respectively. Multiple linear regression analyses will be used to examine the association of relevant independent variables by pillars (e.g. days per week of vigorous physical activity, adherence to the Mediterranean diet, days per week of exposure to nature, among others) with anxiety and depressive symptoms as indicators of well-being and quality of life (dependent variables). Logistic regression analyses will be applied to examine the associations of relevant independent variables by pillars with anxiety symptoms and depressive symptoms as dichotomized variables (no clinical disorder versus potential clinical disorder). Additionally, three-way ANOVA will be conducted to determine between-group differences in anxiety and depressive symptoms related to pillar-relevant independent variables. Relevant variables will be selected from the different pillars with a clear role of independent variable. All analyses will be performed using the STATA software for Windows version 13.0. The level of significance was set at $p<0.05$ in the statistical model.

EXPECTED RESULTS

The anticipated outcomes of the current project are multifaceted and carry significant implications for both research and practice within the realm of YCS.

In terms of lifestyle characterization, the project is poised to offer a comprehensive insight into the diverse array of lifestyle behaviours exhibited by YCS. By delving into their engagement with physical activity, outdoor sports, balanced nutrition, sustainability and nature behaviours, the project aims to fill critical knowledge gaps surrounding the lifestyle habits of YCS. These findings hold promise in guiding international public health strategies geared towards promoting healthier lifestyles among YCS, thereby fostering improved well-being and quality of life.

Moreover, the project seeks to uncover the intricate associations between lifestyle behaviours and the mental well-being and quality of life of YCS. By exploring these correlations, the project endeavours to shed light on the profound impact of lifestyle choices on psychosocial outcomes. It is anticipated that positive lifestyle behaviours, such as increased physical activity and adherence to balanced nutrition, may correlate with enhanced mental well-being and quality of life among YCS. These findings have the potential to deepen our understanding of the intricate interplay between cancer, lifestyle, and mental health, particularly within the European context. As one of the pioneering initiatives to adopt this approach and focus specifically on YCS at a European level, this project stands poised to make significant contributions to the field, shaping future research endeavours and informing targeted interventions aimed at optimizing the well-being of YCS.

On the other hand, as a secondary objective, the project seeks to develop and offer a suite of digital tools for YCS to facilitate easier access to a healthy lifestyle. Expected outcomes include the creation of user-friendly

digital platforms tailored to the specific needs and preferences of YCS, thereby empowering them to adopt and maintain healthier lifestyles. In addition, the project aims to establish a network among YCS by leveraging the developed digital tools and promoting the adoption of healthier lifestyles. It is anticipated that this network will facilitate communication, information sharing, and peer support among YCS, fostering a sense of community and empowerment.

Overall, the expected results of the project have the potential to advance our understanding of YCS' lifestyle behaviours, their impact on mental well-being and quality of life, and the effectiveness of digital tools in promoting healthier lifestyles among this population. These findings may inform future research, clinical practice, and public health initiatives aimed at optimizing the health and well-being of YCS.

AUTHOR CONTRIBUTIONS

S.O.G.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-original draft. A.C.B., and J.G.P.G.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-review & editing. D.J.P.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-review & editing, Supervision. L.D.B., J.V., B.G., S.P.2., P.T., A.V., A.B.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-review & editing. J.T., S.P.1., M.K., F.G., V.R.: Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-review & editing.

SUPPORTING AGENCIES

This work is funded by the European Commission Project – EU4HEALTH "*Outdoor Against Cancer Connects Us*" – Project number 101056984. The research work done by DJP is supported by the Biomedical Research Networking Center on Frailty and Healthy Aging (CIBERFES) and FEDER funds from the European Union (CB16/10/00477). The content is solely the responsibility of the authors and does not necessarily represent the official views of the funding institutions.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

ACKNOWLEDGEMENTS

The authors would like to thank all the organisations, hospitals and other centres that are actively collaborating in the dissemination of the OACCUs Project to reach the target patients.

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Cite this article as:
Ortega-Gómez, S., Di Bartolo, L., Velissari, J., Gomes, B., Ponce-González, J. G., Thaller, J., Papakonstantinou, S., Kirkar, M., Glorioso, F., Rodrigues, V., Pusa, S., Tavares, P., Vantarakis, A., Bianco, A., Carbonell-Baeza, A., & Jiménez-Pavón, D. (2024). The Outdoor Against Cancer Connects Us (OACCUs) Project: A European initiative promoting healthy lifestyle among young cancer survivors. *Physical Activity, Exercise and Cancer*, *1*(2), 53-61. https://doi.org/10.55860/RVJU9406

Types of physical exercise based on the side effects of each oncological patient

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Dear Editor:

There are numerous treatments for cancer, although the most common are surgery, radiotherapy, chemotherapy and target therapies such as immunotherapy or endocrine treatment (Casla-Barrio, 2018).

Each type of therapy acts in a specific way against the tumour and affects each patient differently. This explains the variability of side effects. In addition, their accumulation or the previous health status of each patient also affects the type and degree of side effects of each patient (Casla-Barrio, 2018).

We can find numerous side effects, although we divide them into different groups (Schmitz, 2010). There are different physiological changes that affect how the body functions, in which we find metabolic alterations, increased inflammation, decreased functionality of the immune system or hormonal alterations (Casla, 2015; Kroschinsky, 2017).

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Submitted for publication June 29, 2024.
Accepted for publication June 29, 2024.
Published July 08, 2024.
Physical Activity, Exercise and Cancer.

Identifier: https://doi.org/10.55860/PMTD4351

Among the most important physical changes is the impact on functionality, the decrease in cardiovascular capacity or changes in body composition, highlighting the loss of muscle mass, the increase in fat or the decrease in the amount of bone mass (Casla-Barrio, 2018).

We also see other side effects such as peripheral neural damage, memory loss such as chemo brain, increased risk of cardiovascular diseases, and decreased mood. These side effects are affected by the impact that cancer has on the economic, social and family level (Casla, 2015; Casla-Barrio, 2018).

Different types of exercise have been shown to be effective in reducing the side effects of treatments. This is because exercise acts in different ways, improving the health levels of patients after treatments. They stand out among them (Friedenreich, 2012; Pollán, 2020):

- Regulating surrounding oestrogen levels by reducing fat levels
- Increased sensitivity to insulin which reduces the levels of growth factors associated with this hormone.
- The increase in mitochondrial biogenesis, which improves the functionality and metabolic activity of the muscle, preventing it from degrading, and protecting the central and peripheral nervous system.
- Reduces oxidative levels and protects the structures that provide stability to the genome.
- Improves the activity of the immune system and reduces overall inflammation in the body.
- Improves cardiac functionality.
- Improves peripheral irrigation and improves the functionality and structure of the cardiac pump, which directly reduces the risk of long-term cardiovascular problems.

This means that exercise helps to recover patients' health and quality of life during and after treatments (McTiernan, 2019; Doyle, 2021).

We already know that the ACSM has established a minimum recommended dose for cancer patients that consists of combining cardiovascular exercise, 3 days a week, 30 minutes of moderate intensity (between 70 and 85% of the maximum heart rate), with strength exercise 2 days a week, including 2 blocks of global exercises that include between 8 and 15 repetitions at 60% of maximum resistance. The circuits must contain different types of exercises for the large muscle groups and their number must be adapted to the level of each patient (Campbell, 2019).

In this sense, it is recommended that exercise programs also contain neural, proprioceptive and balance exercises as a basis for the regeneration of peripheral neural activation (Pollán, 2020).

Finally, high metabolic intensity must be included, since it is essential to regenerate the number of mitochondria, reduce body fat or improve the functionality of the cardiac pump (Saberi, 2017).

In addition to all this, we must take into account the initial situation of each patient. In the review published by the Spanish Society of Medical Oncology, recommendations for initial intensity are established depending on the stage of the disease in which each person is. This intensity should be adapted as the patients evolve or the physical, physiological or emotional situation of each one (Pollán, 2020).

Knowing the pathophysiological characteristics of side effects and cancer are essential to be able to implement quality oncological exercise programs that truly impact the patient's health. We already know that

doing "*something*" is not enough, just as we must try to do exercise adapted to the needs of each patient (Schmitz, 2019).

However, another essential challenge is to be able to implement these programs and help patients through appropriate structures and objectives to maintain motivation in exercise, in order to ensure that patients remain active in the long term (Schmitz, 2019).

Keywords: Physical exercise, Physical activity, Exercise, Cancer, Cancer prevention, Cancer treatments, Cancer survivors, Psychology, Sport medicine.

Cite this article as:
Casla Barrio, S., (2024). Types of physical exercise based on the side effects of each oncological patient. *Physical Activity, Exercise and Cancer*, *1*(2), 62-65. https://doi.org/10.55860/PMTD4351

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Physical Activity, Exercise and Cancer (PAEC) and the holistic approach to health for cancer patients/survivors

Petra Thaller . *Outdoor Against Cancer. Munich, Germany.*

Dear Editor:

Physical activity: The cornerstone of healthy habits

Physical Activity (PA) is not only the cornerstone of healthy lifestyle behaviours (Dhuli, et al., 2022) for cancer patients/survivors – physical activity is the magic bull in this field that protects humans from cancer and other non-communicable diseases (NCD's) and guides them into a healthy future.

While the first editorial from our colleague Dra. Soraya Casla Barrio highlighted the importance of the different types of physical activity, I will now highlight the influence of physical activity on healthy lifestyle behaviours in general.

One thing is clear: Cancer patients/survivors have almost the same needs as healthy people (WHO, 2020) depending on the age group when it comes to healthy habits. The key to healthy habits is regular physical activity. The major challenge is how to get cancer patients/survivors physically active?

Physically active humans typically also have healthier dietary choices (Fernandes, et al., 2023) among other positive lifestyle behaviours. They are aware of these positive habits and experience a sense of balance in both physical and mental well-being through their physical activity.

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Submitted for publication July 05, 2024.
Accepted for publication July 06, 2024.
Published July 08, 2024.
Physical Activity, Exercise and Cancer.

Identifier: https://doi.org/10.55860/XTEH3820

The parallel treatment plan

Wouldn't it be great if we could join forces to establish a parallel treatment plan (Gokal, et al., 2024) integrating physical activity alongside medical treatment for cancer patients/survivors? A mandatory plan that guides patients toward a healthier future.

ESMO guidelines for physical activity

"*Despite the recognition in ESMO Guidelines (ESMO, 2018), lifestyle changes like physical activity are not thoroughly embedded in standard cancer treatment protocols. This gap undermines potential enhancements in patient health and treatment effectiveness. Studies have consistently shown that incorporating physical activity into cancer care not only improves treatment outcomes but also significantly boosts quality of life.*" Ph.D. Rūdolf Cešeiko, Exercise Physiologist, Rīga Stradiņš University, OAC Exercise Expert & Advisor. (OAC, 2024).

Sport for all

Dr. Tom Degenhardt, Medical Doctor, M.Sc., General Practitioner & Gynecologist, and OAC Medical Director, called for "*Sports for All: Cancer patients/survivors on prescription*" during this year's Digestive Cancers Europe (DiCE) Masterclass Session 5: Physical Activity for Prevention and Preservation at ESMO in Munich (DiCE, 2024).

Is it a distant dream or a near-future reality?

Keywords: Physical exercise, Physical activity, Exercise, Cancer, Cancer prevention, Cancer treatments, Cancer survivors, Psychology, Sport medicine.

Cite this article as:
Thaller, P., (2024). Physical Activity, Exercise and Cancer (PAEC) and the holistic approach to health for cancer patients/survivors. *Physical Activity, Exercise and Cancer*, *1*(2), 66-68. https://doi.org/10.55860/XTEH3820

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