PHYSICAL ACTIVITY, EXERCISE AND CANCER

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Physical activity: A future standard in cancer therapy

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

Dear Editor:

This Outdoor Against Cancer (OAC) trailer highlights the crucial role of physical activity as an integral part of cancer therapy. Exercise is not just an additional element but an essential component that should be firmly integrated into the treatment of cancer patients. The film presents the latest ESMO (European Society for Medical Oncology) guidelines on physical activity in cancer, emphasising the positive effects of exercise on the quality of life and chemotherapy outcomes for cancer patients (ESMO, 2018). Additionally, it showcases the outstanding work of OAC, an organisation dedicated to promoting physical activity as a key component of cancer therapy.

The two protagonists, Petra Thaller, Founder and President of OAC, and PhD. Rudolfs Ceseiko, Exercise Physiologist, OAC Exercise Expert and Adviser, share their personal stories as cancer survivors and passionate athletes. Both emphasise the transformative power of physical activity during and after cancer therapy. Particularly highlighted is the 4x4 interval training developed by Ph.D. Rudolfs Ceseiko, specifically designed for cancer patients to enhance their physical and mental well-being. (Cešeiko et al., 2019; Cešeiko et al., 2020) Recent studies and reports, including the latest findings from ESMO, demonstrate that the 4x4 training not only improves patients' well-being and quality of life but also helps reduce chemotherapy side effects and promotes long-term survival (Cormie et al., 2017; Patel et al., 2019).

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Petra Thaller discusses her personal journey as a cancer patient and the motivation behind founding Outdoor Against Cancer. Her organisation works closely with leading experts to develop tailored exercise programs for cancer patients. Ph.D. Rudolfs Ceseiko complements this perspective with his expertise in exercise physiology, emphasising the scientifically proven benefits of physical activity. He stresses that exercise supports both the physical and psychological recovery process (Friedenreich, et al., 2016; Ceseiko et al., 2020; Eyl et al., 2020).

The trailer powerfully illustrates how integrating physical activity into cancer therapy is not just an option but a necessity. The protagonists convey a clear message: exercise is life. Implementing these insights in practice can significantly improve the treatment outcomes for cancer patients (Ligibel et al., 2016; Scott et al., 2018; McTiernan et al., 2019).

Producer: Joshua Thaller
Filmed and directed: Zoran Kubura and Bojan Hadziabdic

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

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PHYSICAL ACTIVITY, EXERCISE AND CANCER

ORIGINAL ARTICLE

Humanized care in cancer: What about exercise?

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ABSTRACT

Introduction: The humanization of patient care seeks to address their needs comprehensively, considering more than a clinical diagnosis. In oncology, part of this comprehensive care involves addressing the physical consequences of the process mainly through exercise. Objective: to analyse whether cancer patients were indeed receiving recommendations for physical exercise and whether their experience was. Methods: This is descriptive mixed research. Quantitative data were collected through a questionnaire. Subsequently, participants who met the selection criteria were selected to form a discussion group and collect qualitative data. Results: The quantitative results (n = 40) show that cancer survivors had felt humanization in the health field (77.5%) and in the physical exercise services provided (n = 30; 93.1%). The referral or advice to perform physical exercise came mainly from patient associations (n = 30; 33.3%) and nursing staff (n = 30; 30.0%). In addition, it was stated that the professionalism and empathy of the health and physical exercise professionals were the key points for the perception of humanization. Conclusion: cancer patients perceive that the cares received was humanized both in the medical field and in physical exercise services. However, it is necessary to increase the role of oncologist in referral to this type of services.
Keywords: Patient care, Exercise therapy, Oncology, Oncology nursing.

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INTRODUCTION

Humanized care (HC) can be understood like as the holistic vision of the patient as a person (Diaz et al., 2023; Moro Gutiérrez & González Fernández-Conde, 2022). This procedure has been overriding when the person`s clinic situation is more delicate as in the case of cancer patients (Diaz et al., 2023; França et al., 2013; Grisales-Naranjo & Arias-Valencia, 2013; Moro Gutiérrez & González Fernández-Conde, 2022; Navarrete-Correa et al., 2021). Nevertheless, there is evidence that these patients perceive the care received as dehumanized (Grisales-Naranjo & Arias-Valencia, 2013) mostly due to errors in communication, lack of empathy or misinformation about therapeutic issues (Diaz et al., 2023).

These shortcomings could affect the referral of patients to complementary care services such as physical activity (PA) adapted to the oncology setting (Campbell et al., 2019) leading to unclear prescriptions or recommendations that are not adapted to the specific needs of patients (Martínez Aguirre-Betolaza et al., 2024). On the other hand, it is unknown whether PA professionals follow this holistic view of the patient and correctly complement healthcare. For all the above reasons, the objective of this research was to analyse the experience of a cohort of cancer survivors in terms of overall care and, specifically, in relation to PA services.

MATERIAL AND METHODS

This was mixed descriptive research with two phases: a first quantitative phase (questionnaire) and a subsequent qualitative phase (focus group). It was approved by the corresponding ethics committee and follows the COnsolidated criteria for REporting Qualitative research (COREQ) (Tong et al., 2007).

Participants

Convenience sampling was carried out in cancer survivor associations for the submission of the quantitative questionnaire. No inclusion or exclusion criteria were specified at this stage to avoid sampling bias, and all participants had to give prior consent to access the questionnaire. Also, in this phase, participants could present themselves as candidates for the focus group or not.

For the second phase, the inclusion criteria were: having written consent to participate; having performed PA adapted to the oncological context during or after treatments; and having availability of videoconference connection.

Procedures

The original questionnaire of Bermejo et al. (2011) (Bermejo Higuera et al., 2011) was modified considering the additional information of the subject to be evaluated (Giuliani et al., 2020; Todres et al., 2009). For the focus group, the specific objectives of the session, the sample selection criteria, the role of the authors and a timetable were established prior to the session (Llopis Goig, 2004). The meeting was conducted through a virtual meeting room (Blackboard Collaborate Blackboard Inc., Washington DC, USA), which was accessible by invitation.

Statistical analysis

Quantitative data were analysed through the Statistical Package for the Social Sciences software (SPSS Statistics® v.27, IBM, Armonk, NY, EEUU). Only descriptive analysis was carried out.

RESULTS

40 questionnaire responses were collected and 12 survivors (30.0%) gave their consent to participate in the focus group. For the latter, 6 people (named by an alphanumeric codes S1 to S6) were finally selected after applying the inclusion criteria (Figure 1).

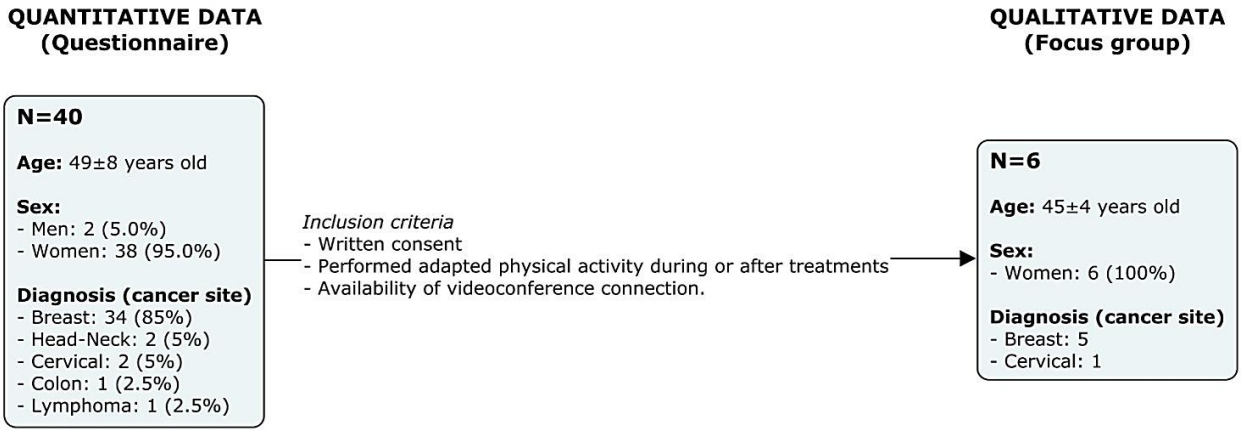

Figure 1. Descriptive data.

Table 1. Humanized care experiences. Quantitative data.

Humanized care experiences		
1. *Would you say that the care you received from health professionals was humanized*? (n = 40)	**Yes**	31 (77.5%)
	No	9 (22.5%)
2. Assign a score to the care received, from least to most humanized (0-5) according to the health professional. If you have not dealt with any of them, leave it blank (n = 40)		
	N	***Score***
Medical oncologist	40 (100%)	2.95 ± 1.66
Radiation oncologist	33 (82.5%)	3.12 ± 1.67
Surgeon	35 (87.5%)	3.46 ± 1.44
Nursery staff	40 (100%)	3.80 ± 1.34
Healthcare Assistants	36 (90.0%9	3.56 ± 1.34
3. *Did you perform physical activity adapted to your diagnosis during or after your cancer treatment?* (n = 40)	**Yes**	30 (75.0%)
	No	10 (25.0%)
4. If you answered "yes", how did you access to that exercise service? (n = 30)		
My oncologist told me about it		2 (6.7%)
Nursery staff (or healthcare assistants) told me about it		9 (30.0%)
A cancer exercise specialist told me about it.		5 (16.7%)
I found out from a patient's association		10 (33.3%)
Other (*I already practice exercise*)		4 (13.3%)
5. *Would you say that the care you received from cancer exercise specialist was humanized?* (n = 29)	**Yes**	27 (93.1%)
	No	2 (6.8%)
	NA	1 (0.1%)

Note. NA: no answer.

Humanized care in the health system

Quantitative data suggest a largely positive experience (Table 1). During the focus group it was suggested that deficiencies in humanization could be due to lack of time, an excessive workload and reduced resources.

The excellence and empathy of medical oncologist was highly valued. Regarding their empathy it was commented that "*these professionals work face to face with death, it is understandable that they establish an emotional barrier (…). Empathy is desirable but not mandatory*" (S6). Another participant added: "*We come to health care as a matter of survival, and you can't choose the oncologist or surgeon. You give yourself up because have no other choice, but you don't think about whether or not they're empathetic*" (S5).

Most of the sample undertook adapted PA after receiving information from patient associations or nursing staff. Those survivors with specific side effects were referred from the health system. In the focus group the main opinion was that this type of referral should be included in the conventional care of all cancer patients to provide truly comprehensive care.

Table 2. Humanized care beliefs. Quantitative data.

Humanized care beliefs (n = 40)		
5. *Indicate your level of agreement: ¿How important do you think each of these aspects are in the humanization of care?* (1: unimportant; 2: little importance; 3: moderately important; 4: important; 5: very important)		
	Professionalism	4.38 ± 1.07
	Commitment, motivation and vocation	3.75 ± 0.74
The professional (doctor, nursery staff, trainer…)	Training	3.75 ± 0.74
	Ethic	3.70 ± 0.75
	Holistic view of treatment	3.75 ± 0.74
	Personal involvement	3.78 ± 0.69
Established relationship with the professional	Communication skills	3.83 ± 0.67
	Empathic attitude and active listening	3.85 ± 0.58
	Resources, comfort…	3.72 ± 0.71
Facilities and organizational issues	Existence of work teams, coordination of personnel	3.83 ± 0.67
	Care for staff	3.85 ± 0.58

6. *Order by priority, from least to most important (0-5), the following characteristics of the professional (healthcare or not) associated with humanization.*

7. *According to each context (healthcare or physical activity services), indicate based on your experience what is the greatest cause of dehumanization*

	Healthcare (n = 40)	**Physical activity services (n = 30)**
The professional	6 (15%)	6 (20.0%)
The established relationship	7 (17.5%)	13 (43.3%)
The facilities	27 (67.5%)	11 (36.6%)

Humanized care in physical activity services

In terms of HC, the experience in PA services was perceived positively commenting in this regard that "*When you go to the medical service, you don't perceive that humanized care because you go in fear. In the gym, the tension drops because you exercise for another purpose than to cure an illness*" (S2). In addition, it was

established that cancer exercise specialist "*are not insisting on the same topic (the disease) all the time*" (S2) and "*During training we are treated as people who have a disease and not as if we were «a disease»*" (S5).

Moreover, those survivors who were forced to manage their own needs added that this allowed them to select a specific type of services and professionals with whom they could connect on a personal level.

Humanized care beliefs

Based on the quantitative results (Table 2) it was discussed in the focus group whether the defining characteristics of HC should be different for professionals in each area. In response, most participants stated that they would not value each professional differently, although others argued the opposite: "*The expectations of each professional are different: I go to the oncologist to save my life, I prioritise that"* (S5).

Thus, when comparing both professional roles, the health professional's excellence was valued more while for the PA professional´s empathy was the priority: "*There are many excellent oncologists and not so many empathetic ones. I will prioritize excellence of my doctor*" (S6). On the contrary, for other participants, empathy has to be implicit in professionalism and independent of academic preparation.

For the last, the hospital facilities and the need to modify their aesthetics were discussed. Considered the most dehumanizing factor in healthcare, they insisted that "*the space where they give you bad news is just important as how they give you that bad news*" (S5).

DISCUSSION

The data suggest that the perception of treatment received by the cohort followed premises of humanisation in both health care and physical activity services. However, the health system did not facilitate referral to such additional care services.

As Leininger (2006) explains, caring to help someone heal is not the same as giving them care considering their human condition in all its dimensions (Leininger, 2006). In this sense, our results suggest that survivors received comprehensive care, as has been noted in other studies (Navarrete-Correa et al., 2021). Nevertheless, it's necessary to highlight that the advice and referral of patients to perform adapted PA did not come from oncologist except in very few exceptions. These data differ from what was previously published (Martínez Aguirre-Betolaza et al., 2024) as well as some consensus documents requests (Herrero López et al., 2024), having even gone so far as to suggest that no recommending PA could constitute a lack of professional ethics (Segarra Vidal, 2024). In relation to this this lack of referral to additional care was excused citing already established reasons: lack of time, work overload, resources limitations and organizational circumstances (Beltrán-Salazar, 2014; Diaz et al., 2023).

In terms of the perceived experience in PA services, the possibility of choosing the professional and the type of service and the fact that professionals in this field were perceived as more empathetic were key. However, the relationship established between professional and patient is considered crucial.

Considering the above and that it has been suggested that effective communication is basic to building a humanised service (Diaz et al., 2023), it is worth highlighting certain guidelines to avoid during communication with the patient, such as the abuse of technicalities, making promises that are not guaranteed or not adapting to the patient's level when giving information (Moro Gutiérrez & González Fernández-Conde, 2022).

In conclusion, although HC was perceived by patients, some gaps have been detected suggesting that communication skills need to be further improved and the importance of referral to additional care services to provide comprehensive care for the individual needs to be emphasised.

Either way, this work is not without limitations, mainly the limited sample size. However, the mixed data collection strategy has allowed us to go deeper into the subject through the personal experiences of the patients collected during the focus group.

CONCLUSION

Although some deficits were detected, cancer survivors perceived HC, also in PA services. It was proposed that excellence, empathy and the quality of the human relationship between patient and professionals are key to maintaining this perception.

AUTHOR CONTRIBUTIONS

The research question was proposed by A.S.; the methodology was designed jointly by A.S. and A.T.; the statistical analysis of the data and the first draft of the text were prepared by A.T.; the final version of the article was reviewed and approved by both authors.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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PHYSICAL ACTIVITY, EXERCISE AND CANCER

ORIGINAL ARTICLE

Needs analysis for the development of a healthy lifestyle module (MoGHS) matriculation co-curriculum course

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ABSTRACT

This study aims to examine the need to create a Healthy Lifestyle Module (MoGHS) to integrate into matriculation co-curriculum courses. This study employs qualitative methods by collecting data through semi-structured interviews with five senior lecturers with more than ten years of experience teaching co-curriculum courses. The report revealed an immediate necessity for the drafting of MoGHS without a specified module, the necessity of standardized reference material for the lecturers, and the need to enhance awareness and practice of a healthy lifestyle among the students. In addition, the results also suggested that the development of MoGHS must encompass four primary constructs, including teaching strategies, teaching, and learning activities, integrated assessment system and integration of soft skills. Hence, the significance of all four of these matters is crucial because it ensures that this module facilitates the efficiency of the PDP and thus enables students to understand and internalize a good way of life in a structured and constructive manner. The results of this study form the basis for a non-controlled, systematic module to support the implementation of a Healthy Lifestyle co-curriculum course in matriculation colleges.

Keywords: Healthy lifestyle module, Co-curriculum course, Needs analysis, Lecturers, Matriculation.

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INTRODUCTION

Globalization has transformed modern society, and healthy living has become a major issue attracting the attention of both the public and health practitioners. A critical aspect of individual welfare is a healthy lifestyle, and educating people helps to raise awareness of healthy lifestyle practices (Pobocha, 2022). As part of the new syllabus, the topic of Healthy Lifestyle has been integrated into the curriculum of the Matriculation College co-curriculum course. However, there is no specific teaching guide as a reference in the process of teaching and learning (PdP). This has caused an indication that the way to deliver this topic is not proportionate among the lecturers; each of them delivered based on experience and the references they had without any guidelines.

A healthy lifestyle is closely linked to individual well-being but also affects students' productivity and academic achievement (Balan, 2023). It has been widely documented that healthy lifestyle practices can improve cognitive performance, relieve stress, and increase the body's resilience to diseases (Fernandes et al., 2024). Henceforth, it's essential to incorporate healthy lifestyle practices in Matriculation-time education to equip students with better knowledge and practices for healthy living.

A more integrated and comprehensive module is necessary for a more coherent and effective knowledge dissemination, with the education system undergoing overhaul (Yermakhanov et al., 2024). A credible and readable module will act as a tutorial not only for the lecturers but also to clarify and understand concepts and implement healthy lifestyles in the students' daily lives. Therefore, this study seeks to determine the needs of lecturers regarding the development of MoGHS for the Matriculation co-curriculum course by examining their perspectives during the needs analysis.

This study seeks to examine the extent to which developing this module can improve the teaching and learning effectiveness of courses within the Matriculation College co-curriculum. This research can be a baseline for creating a more suitable module that should suit students and lecturers nowadays. It is also supposed to achieve expectations of students' interest and involvement in healthy lifestyle habits (Kovalenko, 2024).

METHODOLOGY

This study was conducted using a qualitative approach through semi-structured interviews. A total of five senior lecturers with more than ten years of experience teaching Matriculation co-curriculum courses were selected as study participants.

Data were analysed through interview transcriptions verified by the participants. Martin et al. (2021) emphasize that in needs analysis research, experts can provide a more comprehensive perspective in planning and developing new needs. This study demonstrates that experts have the ability to provide more accurate and professional information in needs analysis.

Construct confirmation process Interviews were conducted to identify the main themes of the Healthy Lifestyle Module. The identified constructs are evaluated by three experts (Cohen & Manion, 2002). Each specialist provides whether the construct is identified to be relevant or not. The agreement between the experts was analysed using Cohen’s Kappa.

RESULTS

The need for MoGHS development

The study findings show that all participants agree on the need to develop MoGHS. The data indicate that 100% of participants agree with the development of this module as it is a new topic in the co-curriculum syllabus and currently lacks a dedicated module as reference material. Lecturers also stated that MoGHS would help deliver information in a more systematic and structured manner.

Rationale for module development

The data analysis identifies the key factors driving the need for MoGHS development:

Table 1. Key factors driving the need for the development of MoGHS.

Need Factor	Description
New syllabus curriculum	The GHS topic has been included in the new co-curriculum syllabus, but no specific module is available.
Absence of a dedicated module	Lecturers teach based on personal knowledge without standardized reference material.
Need for lecturer reference	The module will help ensure uniform teaching delivery across Matriculation Colleges.
Promoting a healthy lifestyle	The module can help students better understand and practice a healthy lifestyle.
Facilitating PdP process	Both lecturers and students will benefit from systematic and structured reference materials.

As highlighted in Table 1, the findings indicate a high need for improvement in the development of MoGHS to ensure a more systematic delivery in the Matriculation College co-curriculum course. The main reasons why this is the case are:

Due to the lack of a module specific to this new topic called the Healthy Lifestyle introduced in the Matriculation co-curriculum syllabus, few reference materials can be provided to the lecturers. A study by Samouei et al. (2020) insists that a responsive education system should offer appropriate learning materials for meeting students' health and well-being needs. Lecturers take classes about their experience and personal references without standard guidelines, leading to inconsistent subject content delivery. According to Speranskaya and Latsevich (2020), the absence of a dedicated module inhibits the ability to work through health education into an integral mechanism since reference structures are not sufficiently defined to be actualized by lecturers and students.

Furthermore, the co-curriculum subject requires lecturers to have reference material to ensure the teaching and learning process can be done consistently and satisfactorily. According to a study by Momot et al. (2020), a pedagogically sound educational environment should provide resource materials that promote effective learning and nurture healthy lifestyle behaviours in students. This module is designed to function as reference material, raise awareness, and install a healthy lifestyle among students—research by Fernandes et al. (2024). The findings of a study showed that structured health education could play an effective role in modifying the students' behaviour toward healthy lifestyle practices and creating awareness regarding the significance of health maintenance.

The systematic module will also ease the teaching and learning process by providing a clear teaching structure and student needs-catered activities. Educational technology as a health manager is essential to students' and educators' effectiveness in teaching and learning (Marushkevich, 2023).

The results of this study validate that MoGHS development is crucial in the matriculation co-curriculum course. This need arises not only due to curriculum changes but also to ensure more structured and effective teaching among lecturers. Previous studies support that quality health education should be based on strong reference materials and appropriate teaching techniques to improve students' understanding and practice of a healthy lifestyle.

Required constructs for the module

The data analysis shows that experts agree on the need for several key constructs in MoGHS:

Table 2. Required constructs and items in the development of MoGHS.

Construct	Requirement
Teaching Strategies	Teacher-centred, student-centred, material-based, problem-solving, and project-based strategies.
Teaching and Learning Activities	Discussions, group presentations, online information searches, field data collection, group problem-solving, note-taking, self-training.
Assessment	Feedback, group presentations, report production, observation.
Soft Skills	Teamwork, ethics and integrity, leadership, communication, lifelong learning, problem-solving.

Table 2 shows the need for a systematic organization of MoGHS to enhance the effectiveness of teaching and learning (PdP). Four main constructs have been identified in the development of this module, namely teaching strategies, PdP activities, assessment, and soft skills.

Teacher-based, student-based, material-based, problem-solving, and project-based strategies are suggested according to MoGHS when developing the teacher guide. Ward and Snyder (2022) highlight the importance of a structured approach to using core teaching practices in health education to promote engaging students and developing teaching strategies that will lead to improved learning outcomes. An important study influencing physical health and physical education courses in higher education institutions (Yun & Mao, 2021) is the significant role of teaching strategies for more effective learning.

In addition, specialists recommend teaching and learning activities. Reading notes, self-study, interviews, group presentations, internet information retrieval, field data surveys, group problem-solving activities, etc. According to a study from Melo & Calheiros conducted in 2023, implementing active learning strategies in health education can increase student experience and participation in class. Group discussions, presentations, and other interactive activities enhance these students' analytical and social competencies.

The second proposed construct is assessment. The techniques used in this module for your assessment are feedback, group presentations, report writing, and observation. Using a systematic approach via the module allows teaching effectiveness to be measured and for an ongoing cycle of continual reflection on it (Kay et al., 2023). In contrast, more complex activities-based assessments and performance-based elements reflect a more holistic perspective of students understanding and the effectiveness of the teaching strategies implemented.

Finally, the construct that experts agreed upon is soft skills. This module must integrate skills like teamwork, ethics and integrity, leadership, communication, lifelong learning, and problem-solving (Elkins, 2013). Hossam et al. (2022), have conducted a study in this regard. health education incorporating soft skills can improve students' healthcare awareness and foster improved interpersonal skill development. A further review (Lin, Lin & Chen, 2020) indicates that teaching strategies emphasizing communication and leadership skills also lessen stress and improve students' mental well-being in the context of health education.

The results from this study indicate that the MoGHS approach should be planned systematically, including various teaching methods, interactive interventions, well-designed assessment methods, and soft skill embedding. The need for the study is supported by earlier studies that showed effective health education must be designed with a clear instructional organization followed by an appropriate assessment technique to ensure students understand and become more involved with the health education learning process.

Reliability of interview data using Cohen's Kappa analysis

Table 3. Agreement value using Cohen's Kappa formula.

P1	P2	P3	Overall score	Approval
$\mathrm{K} = \frac{26-13}{26-13}$	$\mathrm{K} = \frac{26-13}{26-13}$	$\mathrm{K} = \frac{26-13}{26-13}$		
$\mathrm{K} = \frac{13}{13}$	$\mathrm{K} = \frac{13}{13}$	$\mathrm{K} = \frac{13}{13}$	$= \frac{1+1+1}{3}$	1
$\mathrm{N} = 1$	$\mathrm{N} = 1$	$\mathrm{N} = 1$		

Based on Cohen's Kappa analysis in table 3, the coefficient index obtained for the validity of involving 4 constructs and 22 items in this study is 1.00 = very good (Landis & Koch 1977), which indicates full agreement between experts. This means that the constructs obtained from the interviews can be verified as relevant in developing a healthy lifestyle module.

DISCUSSION

This suggests an urgent necessity for implementing the Healthy Lifestyle Module (MoGHS) within the Matriculation Co-Curriculum Course. There is unanimous agreement among all lecturers involved that there is a need for a standardized module because the Healthy Lifestyle subject is new in the syllabus but does not have a specific teaching guide. Lecturers are currently dependent on either personal knowledge or diverse strategies for content delivery, which can cause potential variations in what is taught.

The study identifies key reasons for developing MoGHS, including the need for a standard reference for lecturers, promoting healthy habits among students, and enhancing the teaching and learning process. A structured module will ensure uniform content delivery and effective learning experiences.

Four essential components are recommended for MoGHS: teaching strategies (teacher-centred, student-centred, and problem-solving approaches), learning activities (group discussions, online research, and fieldwork), assessment methods (feedback, presentations, and written reports), and soft skills integration (teamwork, leadership, and communication). These elements will help ensure that students understand and apply healthy lifestyle practices effectively. In conclusion, the study strongly supports the immediate development of MoGHS. A well-structured module will enhance teaching consistency, improve student awareness, and promote a healthier lifestyle.

CONCLUSION

These findings show that the MoGHS development urgently needs the Matriculation co-curriculum course. This need arises as the Healthy Lifestyle content area is introduced in the new syllabus; no specific module is available, and a standardized reference should be provided to implement more systematic and practical teaching delivery. This study also confirms that there is an improvement in MoGHS after integrating various teaching modalities as well as interactive learning activities, systematic assessment, and soft skills. Four constructs were derived from the evidence that structured teaching-multipronged strategies potentially improve students' knowledge and reinforce healthy lifestyle practices.

Future studies should assess this module's effectiveness in teaching and learning to establish how it contributes to students' academic performance and well-being. MoGHS should also incorporate references to physical activity as an essential indicator of students' well-being alongside general healthy lifestyle practices. Regular physical activity improves mental and physical health and is associated with the primary prevention of chronic diseases like cancer.

Recommendations

Integrating physical fitness and nutrition will also benefit students and help them manage stress under the Healthy Lifestyle Module (MoGHS). All these three areas are beautiful and can help you feel physically and mentally, keep chronic diseases at bay, and survive better daily. As a result of a most systematic module, the knowledge learned will be used in everyday life, thus creating a more prosperous generation. However, future research should assess its performance in practice.

AUTHOR CONTRIBUTIONS

Each author was jointly involved in the study's planning, data collection and analysis, as well as the writing and editing of the manuscript.

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PHYSICAL ACTIVITY, EXERCISE AND CANCER

ORIGINAL ARTICLE

Precision physical exercise training for cancer patients: A new trend

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ABSTRACT

There is a growing scientifically supported trend toward understanding physical exercise as a therapy for combating cancer. The objective of this article is to provide a new perspective on oncological physical exercise, relating training variables to the overall cancer situation. Currently, one of the most important trends in sports performance and health is precision physical training, one of the most effective tools for successful implementation of a rigorous and scientific training method. In addition to the above, physical training methods stem from dogmas or theories applied in different sports disciplines and with different populations. For this reason, it has become necessary to understand that there is variation in the individual response of each person to a given physical exercise. Variables such as correct load, number of repetitions, optimal recovery time, speed of execution, correct posture based on biomechanics, and the amplitude of these depending on anthropometry, are similar to the individual biochemistry of each human being. This work aims to promote and support precision physical training in cancer patients, as a new trend to make the survival of our population a reality.

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

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INTRODUCTION

Cancer, one of the leading causes of mortality globally, represents a critical challenge for both medicine and sports science. According to recent data, neoplastic diseases like this one will affect an increasing number of individuals in the coming years, with an estimated 286,664 new cases in Spain by 2024 (Anishchenko-Halkina et al., 2024). This panorama underscores the need for innovative therapeutic approaches that complement traditional medical treatments, not only to control the disease but also to improve the quality of life of those suffering from it. Within this quest, physical exercise has emerged as a multidimensional tool, capable of influencing physiological, psychological, and even immunological aspects in cancer patients. This article focuses on individually tailored precision physical training and its impact on the immune response and quality of life of cancer patients.

Physical exercise, traditionally linked to improvements in cardiovascular and metabolic health, has also demonstrated its ability to influence molecular and cellular processes relevant to cancer treatment. Recent studies have suggested that physical activity can stimulate key immune cells, such as T lymphocytes and Natural Killer cells, while also helping to reduce chronic inflammation associated with cancer progression (Bartlett & Hanson, 2024; Fiuza-Luces et al., 2023). Additionally, regular exercise training alleviates treatment side effects such as chronic fatigue, muscle loss, and changes in body composition (Casla et al., 2023). However, implementing exercise as an integral part of cancer management faces significant challenges, such as the lack of individualized training protocols that consider the specific characteristics of each patient, including tumour type, disease stage, and treatment response.

The main objective of this study is to address the following research question: How can individually tailored precision exercise training influence the immune response and quality of life of cancer patients? To answer this question, a methodological approach is established that allows for the design of training programs tailored to the specific needs of each patient, ensuring their safety and effectiveness. This personalized approach, framed within precision medicine, not only aims to maximize the physiological and psychological benefits of exercise, but also to explore its potential as a complementary immune therapy.

The methodological basis of this work is based on a comprehensive analysis of the available scientific literature, including systematic reviews, preclinical studies, and recent clinical trials. Based on this information, critical synthesis tools are used to evaluate different types of physical exercise and their effects on cancer patients, with a particular focus on aerobic and resistance training, given their positive impact on quality of life and immune modulation (Campbell et al., 2019; Fernández-Lázaro et al., 2020). Additionally, the practical implications of integrating physical exercise into cancer treatment and the design of protocols supervised by specialized professionals are examined.

The article is structured into four main chapters. The first introduces the concept of oncological physical exercise and its relevance as a therapeutic tool. The second chapter develops the conceptual framework of this discipline, emphasizing exercise as an immunological modulator and specific immune responses in cancer patients. The third chapter addresses the prescription of individualized training, exploring how to adjust variables such as intensity and frequency to the unique characteristics of each patient. Finally, the fourth chapter discusses the findings and their implications for the design of therapeutic strategies based on precision physical exercise.

ONCOLOGICAL PHYSICAL EXERCISE

Physical exercise is emerging as a fundamental intervention in oncology, offering benefits that transcend mere physical activity and are integrated into the treatment and recovery of cancer patients. The subtopics will explore how physical activity acts as an immunological therapy, optimizing the immune system's response, as well as its potential to improve quality of life and reduce adverse symptoms during treatment. This comprehensive perspective on exercise highlights its crucial role in contemporary cancer care, placing physical and emotional well-being at the centre of the therapeutic approach.

Exercise as immunotherapy

Physical exercise, increasingly recognized as a therapeutic intervention in oncology, activates key immune cell subtypes, a critical process for strengthening immunosurveillance in cancer patients. This effect includes the stimulation of Natural Killer (NK) cells, CD8+ T lymphocytes, and γδ T cells, which play essential roles in identifying and neutralizing tumour cells (Fiuza-Luces et al., 2023). In particularly aggressive neoplasias, where immune capacity is significantly compromised, the mobilization of these cells becomes a determining factor in improving the body's ability to control tumours The infiltration of these immune cells into tumours suggests improved clinical outcomes, as exemplified by the activity of CD8+ T cells, which induce tumour cell death through specific cytotoxic mechanisms, such as the release of perforins and granzymes. This dynamic reinforces the potential of physical exercise as an effective complement to immunotherapy, maximizing the results of conventional treatments (Fiuza-Luces et al., 2023).

Compared to sedentary lifestyles, physical exercise demonstrates a unique ability to mobilize and activate these immune cells, positioning itself as a complementary strategy that not only protects and strengthens the immune system but also amplifies the effectiveness of treatments such as chemotherapy and radiation therapy. This benefit may be attributed in part to the release of myokines, such as interleukin-6 (IL-6), a key mediator with anti-inflammatory properties that, in the context of cancer, helps counteract the proinflammatory environment that promotes tumour growth (Fiuza-Luces et al., 2023). Unlike chronic inflammatory conditions associated with cancer, exercise-induced myokines act in a beneficial way, not only by decreasing inflammatory markers such as IL-1 and TNF-α, but also by optimizing the tumour microenvironment to hinder malignant progression. This approach suggests that exercise not only delays tumorigenesis but also complements the limitations of traditional pharmacological therapies.

Another important mechanism is the activation of SIRT3, a mitochondrial protein that, under the influence of physical exercise, promotes mitochondrial oxidation and limits the glycolytic metabolism predominant in cancer cells (Bórquez et al., 2018). This process partially reverses the metabolic conditions that facilitate tumour cell proliferation, promoting a normoxic microenvironment less favourable for their growth. Furthermore, SIRT3 regulates redox homeostasis, balancing the production of reactive oxygen species (ROS). This is particularly relevant since excessive levels of ROS not only contribute to oxidative stress but can also indirectly stimulate tumorigenesis. Therefore, this modulation suggests that physical exercise can reprogram cellular metabolic processes, diverting them toward pathways less favourable for the survival and progression of malignant cells.

Regular exercise not only impacts metabolic and inflammatory mechanisms, but also remodels the T lymphocyte repertoire, promoting the proliferation of naive CD8+ T cells while reducing senescent T cells (Fiuza-Luces et al., 2023). This renewal is essential for maintaining a robust immune response to cancer cells and other antigenic challenges. By reducing the number of aging immune cells, systemic inflammation, a component that traditionally compromises the immune environment in cancer patients, is also reduced. In

this context, exercise not only strengthens the adaptive functions of the immune system but also protects against immunosuppression induced by treatments such as chemotherapy. This underscores the potential of exercise as a multifaceted therapeutic tool that transcends the limits of conventional treatments.

The combination of strength and resistance training has a synergistic effect on improving the quality of life of cancer patients, due to its impact on molecular processes and muscle strengthening, both of which are essential during cancer treatments (Anishchenko-Halkina et al., 2024). In addition to optimizing physical function, these interventions have been shown to alleviate symptoms of fatigue and improve psychological well-being, which is crucial for recovery. This multidimensional approach highlights the importance of individualizing training, adapting it to each patient's abilities and needs. In particular, a significant 37% reduction in the risk of cancer-specific mortality has been observed in precision protocols that integrate physical exercise, underscoring its ability to influence relevant clinical outcomes (Friedenreich et al., 2016). This implies that the design of exercise programs should consider the molecular and genetic characteristics of the individual, which could enhance their effects on genetic markers related to cancer recurrence.

Physical exercise has also been highlighted as an effective tool to reduce the risk of developing certain types of cancer by up to 30%, including breast, colon, bladder, endometrial, oesophageal and gastric cancer (Herrero López et al., 2024). Furthermore, regular integration of exercise into the lives of cancer patients is associated with substantial improvements in quality of life, including fewer treatment-related side effects (Herrero López et al., 2024). This evidence supports the role of exercise not only as a preventative strategy, but also as a comprehensive support during and after treatment, positively impacting both the physical and psychological spheres.

In the case of breast cancer, aerobic exercise has shown particular efficacy in increasing lean mass and improving the quality of life of patients undergoing chemotherapy (Galvão & Newton, 2005). This effect not only implies physical benefits but also suggests a direct impact on genetic markers that could reduce disease recurrence. Along these lines, resveratrol, although not directly linked to exercise, shares similar antioxidant and anti-inflammatory effects. This compound, known to modulate key pathways such as NF-κB and MAPK, reinforces the thesis that non-pharmacological interventions, including exercise, can be effectively integrated into cancer treatment plans (Berman et al., 2017).

In addition to other benefits, exercise has been shown to improve key parameters such as cardiorespiratory fitness, reduce fatigue, and enhance self-reported outcomes, especially in cancer surgical and therapeutic settings. These effects are related to the regulation of anabolic and sex hormone production, gene expression linked to apoptosis, and the ability to induce cancer cell death through myokines. (Herrero López et al., 2024). This set of benefits underscores the multidimensional role of physical exercise as an intervention that not only improves overall and disease-free survival rates but also promotes recovery in cancer survivors. In these individuals, exercise has shown lasting benefits, including a reduced risk of recurrence, improved physical function, decreased symptoms of depression, fatigue, and lymphedema, and an overall positive impact on quality of life (Herrero López et al., 2024).

Finally, clinical programs designed for patients with breast cancer have shown improvements in physical performance and a significant decrease in fatigue, demonstrating the positive impact of exercise on recovery and overall well-being during treatment (Fernández-Lázaro et al., 2020). These findings highlight the importance of incorporating physical exercise as a central and strategic component in the comprehensive care of patients with cancer.

Immune response to exercise

Physical exercise, as a therapeutic intervention in oncology, mobilizes key immune cells such as Natural Killer (NK) cells, T lymphocytes, and granulocytes, thereby strengthening immunosurveillance in people diagnosed with cancer. Among these cells, the cytotoxic activity of NK cells plays a crucial role in identifying and eliminating malignant cells. Studies have confirmed that regular, moderate-intensity exercise can significantly increase the functionality of these cells, an effect largely due to repetitive exposure to exercise stimulation, optimizing their long-term immune capacity (Kruijsen-Jaarsma et al., 2013; Quintana Mendias et al., 2021). In this context, the combination of aerobic and strength exercises amplifies not only the mobilization, but also the activation of various cell subtypes, creating a more robust immune response against cancer (Quintana Mendias et al., 2021). However, the specific doses of exercise that maximize this benefit remain to be explored, given that patient needs vary depending on factors such as the type and stage of cancer, as well as ongoing treatments.

Short-term exercise, known as acute exercise, generates a transient increase in circulating lymphocytes, including CD8+ T lymphocytes and NK cells. This effect, mediated by the stimulation of β2-adrenergic receptors due to hemodynamic changes, may be strategic for generating immediate immune responses in tumour contexts (Fiuza-Luces et al., 2023; Bartlett & Hanson, 2024). Although these immune responses are temporary, they may benefit patients with functional limitations who cannot participate in longer-duration training. However, the duration and magnitude of the lymphocyte increase depend on the intensity and type of exercise applied, underscoring the need to personalize training programs (Bartlett & Hanson, 2024). Therefore, careful patient monitoring is crucial to balance the therapeutic potential of immune stimulation with the prevention of adverse effects such as fatigue.

The release of myokines during exercise, particularly interleukin-6 (IL-6), has an essential anti-inflammatory function, counteracting chronic inflammatory processes associated with tumour development. In addition to reducing proinflammatory cytokines such as IL-1, IL-6 enhances metabolic signalling and modulates the tumour microenvironment, hindering cancer progression (Fiuza-Luces et al., 2023; Sirera et al., 2006). This effect is especially relevant in patients with highly inflammatory tumours, where exacerbated inflammation promotes tumour aggressiveness (Bartlett & Hanson, 2024). While research has identified this mechanism as a key benefit of exercise, how to optimize these responses through specific combinations of aerobic and resistance exercise remains to be explored. Furthermore, more evidence is needed on the differential impact of these myokines in various tumour types, as the benefit is likely to vary depending on the unique characteristics of each cancer.

High-intensity programs, such as those implemented in the HI AIM trial, show significant benefits by increasing the density of circulating NK cells and their infiltration into solid tumours, including lung tumours (Holmen Olofsson et al., 2022). This type of training, supervised and carefully dosed, not only improves physical capacity, but also positively affects the cellular composition of the tumour microenvironment, slowing the progression of neoplasia (Holmen Olofsson et al., 2022). However, this intensive approach is not suitable for all patients, as some may have limited physical abilities that make it difficult to implement. Therefore, proper monitoring and customization of these programs are essential to avoid burnout or adverse effects (Bartlett & Hanson, 2024). In addition, further studies evaluating how to tailor intensities to individual clinical needs should be considered.

Regular exercise remodels the T cell repertoire, increasing the proportion of naive T cells and reducing senescent T cells. This effect improves immune function, a crucial factor in cancer patients experiencing immunosuppression caused by both the disease and treatments such as chemotherapy (Fiuza-Luces et al.,

2023; Shaver et al., 2021). Studies indicate that these changes promote a more rejuvenated immune system, capable of responding efficiently to new antigens and fighting tumour cells (Shaver et al., 2021). Although these findings are promising, the long-term impact of this remodelling on survival and reduction of cancer recurrence needs to be further investigated. Likewise, the role of different exercise modalities in this remodelling needs to be explored to identify more effective protocols for reducing immunosenescence.

A personalized approach to exercise prescription is vital to maximize its immunological benefits and ensure the safety of people with cancer. For example, programs combining moderate-intensity aerobic and strength training have been shown to be effective in breast cancer survivors, improving parameters such as oxygen consumption and muscle strength (Fernández Ortega & de Paz Fernández, 2014; Galvão & Newton, 2005). These improvements are directly related to positive changes in immune markers, underscoring the importance of tailoring training to each patient's specific needs and conditions. Furthermore, professional supervision is essential to progressively adjust exercise doses and intensities, avoiding adverse effects such as overtraining, which could compromise immunological benefits (Galvão & Newton, 2005). However, there remains a need to standardize protocols that appropriately balance therapeutic benefits and individual physical limitations, especially in cases of post-surgical recovery or compromised physical function.

In summary, physical exercise exerts profound immunological effects that strengthen immunosurveillance and optimize metabolic and inflammatory processes associated with tumour control. Its personalized implementation, tailored to the individual characteristics of cancer patients, promises to maximize these benefits, although further research is needed to address the barriers and limitations of certain therapeutic approaches.

PRESCRIPTION OF PRECISION PHYSICAL TRAINING

Prescribing physical training for cancer patients must be a meticulous process that considers various individual factors, including the type and stage of cancer, medical treatments received, and the patient's initial physical condition. Considering these variables is essential to ensuring a safe and effective program, given that physical abilities and exercise tolerance can vary significantly among patients. For example, the stage of cancer can determine specific limitations due to disease progression, while the side effects of treatments such as chemotherapy or radiation therapy can influence functional capacity, muscle strength, and endurance (Tejada-Medina et al., 2020). A thorough initial assessment should be supported by specific tests, such as Gait Speed, which not only measures the patient's functional capacity, but also serves as a predictor of possible complications (Inzitari et al., 2017; Moraga Rojas & Uclés Villalobos, 2023).

Initial fitness assessment is a crucial aspect of developing individualized exercise programs for cancer patients. Variables such as aerobic capacity, muscular strength, and functionality must be carefully assessed using objective tests. These measurements allow for the design of exercise plans tailored to the individual's current abilities and establish a benchmark for monitoring progress. Assessment batteries such as Gait Speed offer an accessible and efficient method to determine physical functionality, while advanced metrics such as maximum oxygen consumption provide details on cardiovascular capacity and help personalize training goals (Inzitari et al., 2017; Moraga Rojas & Uclés Villalobos, 2023). However, the usefulness of these tools could be enhanced by integrating new wearable technologies that allow for continuous, real-time monitoring of a patient's physical abilities, thereby optimizing the necessary adjustments to exercise prescriptions.

Training design must take into account the specific limitations associated with the side effects of cancer treatments. Conditions such as sarcopenia, chronic fatigue, and osteoporosis, among others, require strategies aimed at minimizing their impact. For example, resistance training, focused on improving muscle strength, has been shown to be particularly useful in combating sarcopenia, while moderate aerobic exercise contributes to reducing chronic fatigue by improving oxygenation and mitochondrial function (Marco Continente et al., 2020). In turn, regular physical exercise can mitigate adverse changes in body composition and muscle mass loss, thus improving the patient's overall health (Casla et al., 2023). However, the implementation of these programs should be progressive and based on consistent monitoring, as inadequate intensity could exacerbate these conditions. In this context, the incorporation of combined modalities, such as strength and aerobic training, can provide comprehensive benefits by addressing multiple side effects simultaneously.

The appropriate selection of exercise modalities to address the needs of cancer patients is critical to ensuring the best possible outcomes. Modalities such as aerobic and strength training have shown specific benefits. Moderate-intensity aerobic exercise, combined with resistance training, not only improves quality of life by reducing anxiety and fatigue, but also strengthens the immune system (Campbell et al., 2019). On the other hand, resistance training is essential for preventing sarcopenia by increasing muscle strength and improving functional capacity (Marco Continente et al., 2020). The combination of these exercise modalities demonstrates a multidimensional approach, addressing both physical and psychological aspects of cancer treatment. In addition, impact resistance exercise has shown specific benefits in activating calcium absorption at the level of bones such as the hip and femur, contributing to the prevention of osteoporosis, especially in women who are breast cancer survivors. (Casla et al., 2023). In addition, impact resistance exercise has shown specific benefits in activating calcium absorption at the level of bones such as the hip and femur, contributing to the prevention of osteoporosis, especially in women who are breast cancer survivors.

The effectiveness of supervised programs during treatments such as chemotherapy underscores the importance of adjusting exercise progression according to each patient's condition. Studies have shown that these programs reduce perceived fatigue and improve immune system function by increasing the activity of NK cells and T lymphocytes, both essential in the body's defence against malignant cells (Galvão & Newton, 2005). This progressive approach, which begins with low-intensity exercises and gradually increases according to the patient's response, not only improves adherence but also minimizes injury risks (Tejada-Medina et al., 2020; Zardo et al., 2022). Furthermore, in premenopausal women, high-intensity aerobic exercise has been shown to be effective in reducing oestrogen levels, while resistance training decreases sex hormones in postmenopausal women, which could have positive implications for breast cancer control (Casla et al., 2023). However, greater standardization of protocols is needed to define optimal intensity and frequency ranges that maximize benefits across different types and stages of cancer.

The implementation of objective measurements, such as walking speed and maximum oxygen consumption, reinforces the accuracy of exercise programs by providing concrete data on the patient's initial condition and progress. These metrics not only serve as functional indicators of physical progress, but also help identify potential risks during training, such as excessive fatigue or cardiovascular decompensation (Inzitari et al., 2017). Routinely incorporating these assessments could significantly improve the personalization of exercise programs, adjusting dosages according to individual physiological capabilities and specific medical conditions.

Physical exercise is also an effective tool for managing the side effects of cancer treatments, such as sarcopenia and osteoporosis. High-impact resistance exercises have been shown to be particularly effective

in improving bone density, especially in breast cancer survivors, who are at increased risk of developing osteoporosis due to hormone therapy and chemotherapy (Marco Continente et al., 2020). Likewise, regular exercise helps prevent muscle deterioration associated with sarcopenia, improving daily functioning and quality of life (Campbell et al., 2019). Furthermore, the combination of aerobic and strength-endurance exercises contributes to the reduction of cardiovascular risk factors, a side effect frequently associated with cancer treatments. However, it would be important to explore additional exercise combinations for patients with specific comorbidities, which could further expand the benefits of these interventions.

Adherence to physical exercise continues to be a significant challenge in the oncology population, due to physical, emotional, and practical barriers that hinder the implementation of regular activity programs. Lack of education about the benefits of exercise and ignorance about its role in improving clinical outcomes contribute to the fact that most survivors do not meet the minimum physical activity recommendations (Hidrobo Coello, 2020). Programs that include educational and motivational sessions, designed by specialized professionals, have been shown to be effective in reducing this initial resistance and promoting sustainable exercise habits (Tejada-Medina et al., 2020). Furthermore, personalized guidance is key to overcoming individual barriers and providing patients with the necessary tools to incorporate exercise as an integral part of their recovery. The inclusion of remote monitoring technologies, such as mobile apps, could also facilitate follow-up and increase adherence by improving accessibility and ongoing support.

Overall, prescribing an individualized and carefully planned exercise program for cancer patients must address not only physical needs but also emotional and practical barriers, ensuring a holistic and effective experience. This underscores the importance of expanding research in this area to optimize intervention strategies.

CONCLUSION

This article has exhaustively explored how precision exercise can act as a significant therapeutic intervention in oncology, improving both the immune response and the quality of life of cancer patients. The central objective of this research was to demonstrate the scientific basis supporting the use of exercise as a complementary tool in cancer treatment, and this objective has been clearly achieved by demonstrating its multiple immunological, metabolic, and functional benefits in this group of patients. The literature review has allowed us to contextualize and consolidate the role of physical exercise within a comprehensive approach to personalized medicine, exceeding expectations in terms of its therapeutic implications.

The document highlights that physical exercise, particularly when designed and tailored to a patient's individual characteristics, has a profound impact on improving key immune processes. Specific mechanisms have been identified by which exercise positively modulates the activity of immune cells such as Natural Killer cells and CD8+ T lymphocytes, which are essential for tumour immunosurveillance. Furthermore, scientific evidence shows that exercise can significantly reduce chronic inflammation, a critical factor in cancer progression, and optimize the metabolic microenvironment, hindering the proliferation of malignant cells. These benefits have not only been supported by quantifiable data from previous studies but also align with recent research that underscores the need to integrate exercise into conventional oncology treatments.

In this context, it is established that personalization in exercise prescription is essential to maximize its effectiveness and ensure patient safety. Through the compilation of research, it has been determined that combined aerobic and resistance training programs are not only feasible but also positively impact quality of life by reducing fatigue, preventing sarcopenia, and improving psychological well-being. The findings

reinforce the need to individualize these interventions based on objective baseline functional assessments, such as gait speed and maximum oxygen consumption, to design programs that respond to each patient's limitations and abilities. This has not only met the initial objective of the study but also opened up new avenues for improving existing clinical protocols.

The contribution of this research to the global context of oncology is significant, as it consolidates the evidence that physical exercise can go beyond the traditional benefits associated with physical activity. This work details how exercise, accompanied by professional supervision, can effectively complement current pharmacological treatments, such as chemotherapy and radiotherapy, increasing their effectiveness and reducing associated side effects. Particularly relevant is the fact that this perspective aligns with pioneering research such as that of Fiuza-Luces and Friedenreich, offering a theoretical and practical foundation that underscores the role of exercise in improving clinical outcomes and survival in cancer.

However, the research presented is not without limitations. Although multiple aspects have been addressed, the reliance on secondary studies and the variability in measurement methods among the analysed studies limit the generalizability of the findings. Furthermore, gaps in knowledge persist regarding optimal exercise doses, intensities, and modalities for different cancer subtypes and disease stages. These shortcomings call for well-controlled clinical studies that allow for the validation and standardization of specific protocols, addressing aspects such as the practical and emotional barriers that have been identified as obstacles to exercise adherence in this population.

In terms of future projections, we suggest prioritizing research that delves into the molecular mechanisms underlying the effects of physical exercise on the immune system, exploring how interventions designed for cancer patients can optimize genetic and molecular markers that impact cancer recurrence and progression. Furthermore, it would be valuable to explore innovative combinations of exercise modalities that consider each patient's individual characteristics and associated comorbidities, thus maximizing the overall benefits of treatment. Furthermore, greater attention is needed to design educational and motivational strategies to increase adherence to exercise programs, integrating technologies such as mobile applications and wearable devices that facilitate remote monitoring and ongoing follow-up.

In the context of rising cancer incidence, this research reinforces the importance of implementing innovative therapeutic approaches that not only focus on prolonging survival but also on improving patients' quality of life. Physical exercise is emerging as a key tool in this more humane and multidimensional approach to cancer treatment. Incorporating precision exercise programs into clinical practice should not be considered optional, but rather an essential component of comprehensive care. This work highlights the commitment to finding new strategies that address not only patients' physiological needs but also their emotional and psychological well-being, marking a breakthrough in precision healthcare applied to oncology.

AUTHOR CONTRIBUTIONS

All co-authors have contributed equally at each stage of this article. All co-authors have agreed to its publication in PAEC.

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PHYSICAL ACTIVITY, EXERCISE AND CANCER

ORIGINAL ARTICLE

Social expansion of rowing as a therapy for breast cancer

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ABSTRACT

The article analyses the impact of rowing on women breast cancer survivors, promoting physical exercise and emotional recovery. The "*Vence-remos*" programme seeks to improve the health and quality of life of these women through adapted rowing. It highlights the creation of support networks and the overcoming of stigmas about female fragility. Participation in this sport has increased significantly, promoting gender equality in sport.
Keywords: Physical activity, Emotional recovery, Cancer survivors, Gender equality, Quality of life.

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INTRODUCTION

This article analyses its impact on promoting women's sports and physical exercise among women who have faced the challenge of overcoming breast cancer. In this area, exercise is presented not only as an enriching physical activity but also as a vehicle for empowerment and recovery for women who have experienced the physical and emotional impact of the disease.

In this sense, rowing, requiring precise timing and a collaborative effort, stands as a vehicle for collaboration and solidarity, values that translate significantly into the sociocultural sphere. In this sense, rowing, requiring precise timing and a collaborative effort, stands as a vehicle for collaboration and solidarity, values that translate significantly into the sociocultural sphere.

From a sociological perspective, the active participation in rowing by women who have battled breast cancer challenges entrenched notions about female fragility and highlights the resilience and strength inherent in these women. Likewise, this participation contributes to the creation of support networks that transcend individual barriers and become living testimonies of the human capacity to overcome significant challenges.

In this article, we aim to explain how action research can impact the practice of sports in the society in which we live. To this end, we present how the research conducted by the PAI CTS-563 Research in Sport Science group has managed to impact the society in which it operates.

According to the World Health Organization (WHO, 2019), there are 2.3 million new cases and 458,000 deaths from breast cancer each year. In 2020, breast cancer surpassed lung cancer, which has been the leading cause of death for many years. Therefore, we are facing the most common cancer in the world and it also has the particularity, not insignificant, that it affects women more than men.

Current knowledge about the causes of breast cancer is insufficient, so early detection remains the cornerstone of the fight against this disease. When it is detected early, properly diagnosed, and treatment is available, the chances of a cure are high (Hayes et al., 2006; Fujimori, 2010; Tiezzi, 2014).

According to the European study Eurocare 6 (2023), the number of breast cancer survivors in Spain is 83% five years after surgery, slightly higher than in the rest of Europe. This rate is linked to the effectiveness of treatments, an increase in early diagnosis, and prevention of relapse (Cantarero-Villanueva, et al., 2004). In Spain, approximately 30,000 cases are diagnosed each year; in other words, one in eight women will suffer from this disease in their lifetime. Thus, each year, more and more people are surviving cancer, and with them, the demand for new care needs for this group increases. Therefore, the fight against cancer should not be so much about preserving a person's life but rather maximizing their quality of life.

Although the disease has become chronic, receiving a diagnosis of cancer and living with it entails a series of physical and psychological consequences for the person suffering from it and their family members, which appear from the moment of diagnosis and continue throughout the different phases they go through.

The aggressiveness of oncological treatments and their side effects generate high physical and emotional symptoms in patients (Valentín, Murillo & Royo; 2004), and numerous studies have been carried out on the nature of the psychological consequences of treatments and the possibilities and resources for adaptation of patients (Gontijo Garcia, Meira, de Souza, & Guimarães, 2023; Niedzwiedz, Knifton, Robb, Katikireddi, & Smith, 2019; Roscoe, Pringle, Chandler, Faghy, & Barratt, 2022; Stein, Syrjala, & Andrykowski, 2008).

Physical symptoms such as asthenia or fatigue, pain, and lymphedema negatively impact patients' health, increasing emotional distress. Regular physical activity reduces the risk of breast cancer by 38%, and in patients with the disease, physical exercise increases survival when a cure is not possible, improving quality of life (IARC, 2020).

According to the Spanish Rowing Federation, this is a sport that consists of propelling a boat on water, using the muscular force of one or more people, each of them using one or two oars as simple second-degree levers and sitting with their backs to the direction of progress, with or without a helmsman to guide them.

Despite the significant benefits its practice offers to athletes, it is a minority sport due to the conditions it requires. Typically, a close body of water and relatively stable weather, with no winds that could alter the water conditions.

Furthermore, this sport not only does not require great physical fitness but also greatly improves the quality of life of its practitioners, improving both physical and mental condition (Asensio-García et al., 2021; Volianitis, Yoshiga, & Secher, 2020). However, as we said before, although the benefits are tangible, it is a minority sport.

The Vence-remos study aims to improve the physical condition, health perception, and body composition of women who have overcome breast cancer. In fact, the title "*vence-remos*" clearly alludes to overcoming the after-effects of treatments following a breast cancer diagnosis (chemotherapy, radiotherapy, experimental treatments, etc.) through adapted rowing. But the title also hides another nuance: the person performing the action of the verb: the first person plural: we, or in this case, us!

Since this entire project is group-based, another part of the philosophy of this research study that has demonstrated the benefits of (adapted) rowing in this population is that it is always practiced in team boats, that is, in the company of other women with similar pathologies who serve as a support group (they are the backbone, the companion, and the support group), but also under the supervision of qualified personnel: Graduates in Sports Science. Let's say that the legendary song by Richard Rodgers and Oscar Hammerstein, also known as the anthem of Liverpool F.C., has been taken, and the "*you'll never walk alone*" has become "*you'll never row alone*".

METHODOLOGY

The main objective of this article is to understand the social and sporting impact of the research project developed in Malaga and Seville since 2019, thanks to the CTS-563 Research in Sport Science research group.

From the beginning, we have worked closely with the Andalusian Rowing Federation and various clubs to ensure that this new sports field, open to women who have survived breast cancer, remains accessible after the research project concludes.

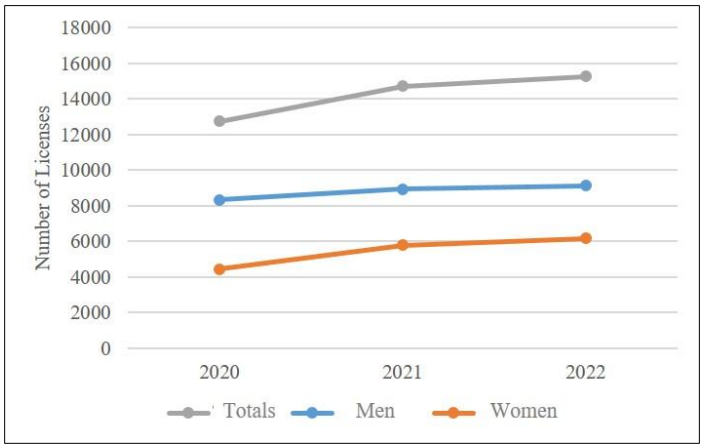
To obtain data, we have consulted the National Statistics Institute, the Ministry of Culture and Sport, the Institute of Statistics and Cartography of Andalusia, and the Andalusian Rowing Federation to find out the number of practicians.

RESULTS

According to the National Institute of Statistics (2023), in the middle of the year, in Spain there were 48,446,594 inhabitants, of which 23,726,731 were men and 24,719,863 were women.

According to the Institute of Statistics and Cartography of Andalusia (2023), there are 8,484,804 inhabitants in our region, of whom 4,182,620 are men and 4,302,184 are women. As can be seen, there are more women than men. However, if we focus on the world of sports, we find a paradox:

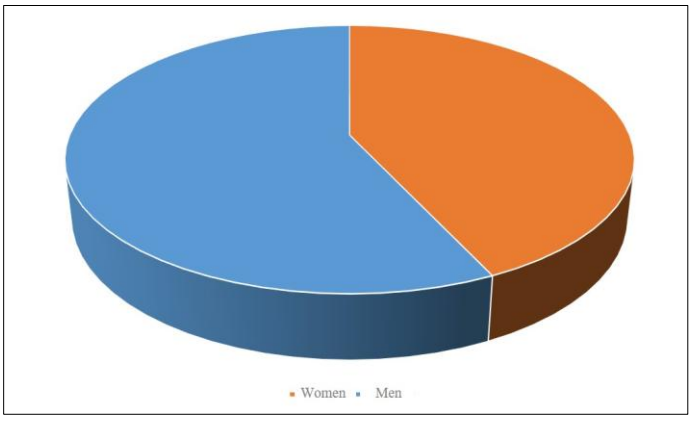
According to the Ministry of Culture and Sport (2023), the number of sports licenses (federated athletes) is 4,107,300, of which only 24.3% are women. In the specific case of rowing, in 2022, there were 15,266 federation cards, of which 6,158 were female. As can be seen, it is a fairly feminized sport, however, 40.34% of licenses are female, well above the population average.



Source: Ministry of Culture and Sport (2023).

Figure 1. Number of rowing licenses by gender in Spain.

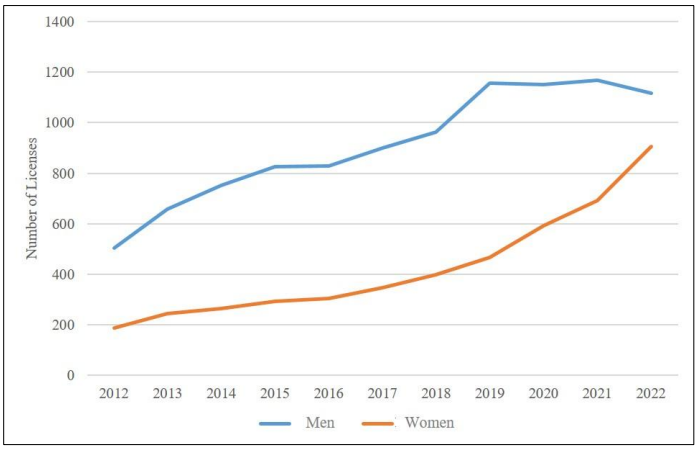
In Andalusia, in 2022, there were 1,974 federation licenses, of which 849 were female, equivalent to 43% of the population.



Source: Ministry of Culture and Sport (2023).

Figure 2. Number of rowing licenses by gender in Andalusia.

According to the Andalusian Rowing Federation, the number of licenses has been increasing over the last ten years. Indeed, the number of licenses has increased by 254% in the last ten years, rising from 694 athletes in 2012 to 1,763 in 2022. This is undoubtedly the result of the Federation's successful policies. But it's not just the statistic that stands out: doubling the number of licenses. There's also a clear commitment to the inclusion of women in sports, as can be seen in the following graph: ten years ago, 189 women rowed (as part of a federation) in Andalusia, while last year, 907 athletes did so.



Source: Andalusian Rowing Federation.

Figure 3. Number of rowing licenses in Andalusia.

Comparatively, this figure is striking, as in 2012 only 27.23% of rowing federation members belonged to women. In 2022, this figure rose to 46.13%. In other words, almost half of all federation members belong to women.

This leads us to reflect on the various policies of the Andalusian Rowing Federation to promote women's sport, which, in light of the results, have been very satisfactory, as the number of women's licenses has quadrupled in the last ten years. Of all the policies implemented by this federation to promote women's rowing, we must highlight the promotion of the Vence-remos program in different clubs throughout Andalusia, as well as the organization of various meetings for women with breast cancer and the creation of the BCS category (an acronym for Breast Cancer Survivor).

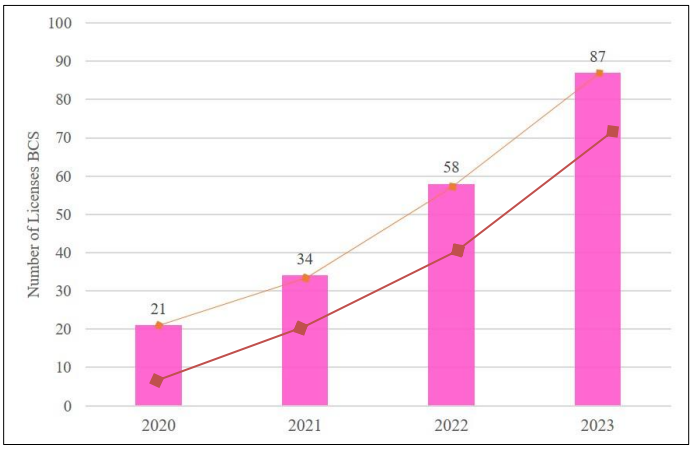
Thanks to the Federation's support for the Vence-remos project, there are now several clubs in Andalusia where women who have suffered from breast cancer can practice rowing tailored to their circumstances and characteristics. Below are the various clubs and locations:

Table 1. Clubs with BCS category that have launched the Vence-Remos Project.

Cádiz	Algeciras: Pink Flags La Línea de la Concepción: Vikingas del Estrecho.
Málaga	Málaga: Real Club Mediterráneo: Malaga D.B. La Cala del Moral: Vikingas Rosas El Candado: El Candado con Ellas Faro de Torre del Mar/Vélez Málaga BCS Esperanza
Sevilla	Leonas del Guadalquivir

A separate study consists of the analysis of the names of each of these groups of women, as well as the synergies that have been established between Rowing Clubs and Associations of Women with Breast Cancer in the different cases.

Although the Vence-remos project is an educational approach (since the vast majority of women had never rowed before) and despite the recommendation to register for a federation due to the benefits it entails (including medical insurance in case of an accident during the activity), there is still a group of women who are not federated due to the competitive connotation of being federated. However, thanks to the pedagogy of explaining the advantages of having a federation card, the number of licenses has increased year after year.



Source: Andalusian Rowing Federation.

Figure 4. Annual evolution of the number of licenses in the BCS category.

Finally, it is necessary to make it known that this influence of the research project has not remained in Andalusia, but has crossed our borders and there are already other initiatives at a national level that are beginning to support women with breast cancer, such as those of the Concello de Ares (Coruña) with its "*Sirenas de las Mirandas*", in the Levante: Rema Vida (Alicante), Anémona (Benidorm), Rem Cambrils (Gerona), and another is in the process of being created in Tortosa through its rowing club.

CONCLUSIONS

From a research perspective, the Vence-remos project aimed to demonstrate how adapted rowing had a positive impact on improving the health, physical condition, and mental well-being of women who had suffered from breast cancer. These objectives have been achieved and published in various scientific articles (Gavala-González, Gálvez-Fernández, Mercadé-Melé, & Fernández-García, 2020, 2021; Gavala-González, Torres-Pérez, & Fernández-García, 2021).

But from a sociological perspective, it has become a social phenomenon: a means of women's empowerment. This element has been embraced by various public bodies, such as the Seville City Council (which organized, through its Equality Delegation, a meeting called Row for Life), or the Andalusian Rowing Federation, which has transformed women's sport in Andalusia by creating a new category in numerous regattas: the BCS category, as well as providing support for women who have suffered from breast cancer.

Under the motto "*You'll never row alone*," rowing is a symbol of hope that more and more female athletes identify with. It's not just a way to spend their free time, but also a philosophy of life that teaches us values such as resilience, camaraderie, and the will to believe that together we can overcome difficulties. In this sense, the rowers most affected take the helmsman position, becoming the boat's guide and a fundamental component without which the vessel would not reach its destination. At the same time, each athlete paces themselves to keep moving forward and overcome the difficulties along the way with their own efforts and the help of a group of teammates in similar situations. No one is superfluous on the boat; everyone is necessary. As we can see, group therapy and empathy play a fundamental role in these training sessions, which go beyond the inherent benefits associated with sports activities.

For women who have survived breast cancer, rowing not only offers beneficial physical exercise but also provides a platform where self-improvement intertwines with building strong social relationships. The mutual understanding and support generated in the rowing environment not only contribute to physical rehabilitation but also act as a salve for the emotional wounds that may linger after treatment.

Furthermore, another important factor from a sociological perspective is equal opportunities in sports for women and girls who want to engage in physical activity. As we can see, the number of federation licenses for female athletes has gradually increased in recent years, but traditionally, the percentage of athletes who rowed was predominantly male. Through initiatives of this type, driven by the support of the corresponding federation, we can promote gender equality in the world of sports.

As we have seen, rowing is proving to be an agent of change in the sociological narrative of women's sport and post-breast cancer recovery. Beyond statistics and clinical data, rowing becomes a means by which women not only regain their physical health but also reaffirm their identity, strengthen their social ties, and challenge the limited perceptions society may have of them. This phenomenon, from a sociological perspective, illustrates the transformative power that sport can have in building a more inclusive and understanding society.

This article has shown how university research can positively impact the society in which it is carried out. Thus, a project that was initially planned to test the benefits of physical activity (in this case, rowing) in women with breast cancer, thanks to the synergy and support of other social stakeholders (clubs, city councils, associations of women with cancer, federations, etc.), has not only endured over time and become a reality, but has also become an alternative to medical treatments... Perhaps one day medicine will prescribe physical activity for what we have been advocating for so long: *"Sport adds years to life and life to years".*

AUTHOR CONTRIBUTIONS

Mateo Real Pérez, original idea and coordinator of all the research. Alexis Jurado Lavanant, data collector. Ana María Mosquera Gamero, data collector. Francisco Javier Márquez García, data collector. Jose Antonio García García, data collector and editor of the paper. José Miguel Álamo Mendoza, data collector and drafter of the paper. Noelia Moreno Morales, data collector and drafter of the paper. Álvaro Reina Gómez, statistical processing. Óscar Caro Muñoz, statistical processing. Hayda G. Molero, data collector. José María Hinojosa Montañes, data collector. Juan Gamboa González, research design and data collector.

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