

Variables related to Physical Exercise in Cancer Patients and Survivors

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Abstract

Cancer constitutes a significant global contributor to morbidity and mortality, inducing adverse effects that impact individuals both during and after treatment. Noteworthy among these effects are depression, anxiety, fatigue, and diminished quality of life. This study aims to ascertain the association between quality of life, fatigue, depression, and anxiety variables and engagement in physical exercise within a cohort of cancer patients and survivors affiliated with the Spanish Association Against Cancer of Cantabria. Additionally, the investigation seeks to identify barriers contributing to physical inactivity in this demographic. Employing a descriptive research design, this study endeavours to illuminate the interplay between these factors in the specified population. A survey was conducted to assess variables such as physical exercise levels, quality of life, fatigue, depression, anxiety, and barriers to physical activity. The findings indicated correlations between physical exercise and depression ($p=0.002$), anxiety ($p<0.001$), fatigue ($p<0.001$), and quality of life ($p<0.001$) in both cancer patients and survivors. Similarly, survivors exhibited associations between physical exercise and depression ($p<0.001$), anxiety ($p<0.001$), fatigue ($p<0.001$), and quality of life ($p<0.001$). Conversely, patients and survivors demonstrated significant differences in individual ($p<0.001$), interpersonal ($p=0.002$), community-institutional ($p=0.001$), and time-obligations ($p=0.002$) barriers. The outcomes affirm the impact of physical exercise on depression, anxiety, fatigue, and quality of life among both cancer patients and survivors, while also elucidating the barriers that rationalize physical inactivity within this demographic.

Keywords: Cancer, Physical Exercise, Anxiety, Depression, Fatigue, Quality of Life, Barriers.

Introduction

Cancer, characterized as a systemic ailment, arises from the unregulated proliferation of aberrant cells leading to their infiltration into neighbouring tissues or dissemination to distant organs (Bertram, 2000). It stands as a predominant contributor to global morbidity and mortality (Azevedo, Viamonte, & Castro, 2013). In the year 2022, Spain recorded the diagnosis of 280,100 cases, signifying a heightened incidence compared to preceding years (Sociedad Española de Oncología Médica, 2022). Likewise, projections indicate an anticipated elevation in cancer incidence, with an estimated 341,000 cases expected by the year 2040 (Sociedad Española de Oncología Médica, 2022).

In Spain in 2022, the most prevalent cancer diagnoses encompassed colorectal, breast, lung, prostate, and bladder cancers. Conversely, less frequently diagnosed malignancies included non-Hodgkin lymphoma, pancreatic and renal cancers, malignant cutaneous melanoma, cancers of the oral cavity and pharynx, uterine body, stomach, and liver (Sociedad Española de Oncología Médica, 2023).

Cancer-associated fatigue represents a significant and burdensome consequence of the disease, manifesting both prior to and following its therapeutic interventions (Ryan et al., 2007). The National Comprehensive Cancer Network (Berger et al., 2010) characterizes cancer-related fatigue as a distressing, enduring, subjective perception of physical, emotional, and/or cognitive depletion associated with cancer or its treatment, disproportionate to recent exertions and disruptive to daily activities (Berger et al., 2015). Its pathophysiology is characterized by multifactorial influences, among which are psychological alterations (Servaes, Verhagen, & Bleijenbergh, 2002), endocrine dysfunction and disruptions in energy metabolism contribute to its pathophysiology (Ryan et al., 2007), pain (Ebede, Jang, & Escalante, 2017), rheumatic complications also play a role in its pathophysiology (Ryan et al., 2007), and inflammatory cytokine production is an additional factor influencing its pathophysiology (Ji et al., 2017; Kolak et al., 2017).

The prevalence of depression is notably high within the demographic of individuals diagnosed with cancer (Bagué, 2015). According to the World Health Organization (2014), cancer is recognized as a

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common mental disorder, characterized by the potential for chronicity or recurrence, markedly impairing occupational functioning and daily life adaptation. Empirical findings indicate a major depression prevalence of 15%, depression under 20%, and a minor anxiety prevalence of 10% among individuals with cancer (Mitchell et al., 2011). Moreover, among cancer patients diagnosed with depression, two-thirds concurrently exhibit symptoms of anxiety (Smith, 2015).

Similarly, anxiety is a prevalent issue observed in both cancer patients and survivors, with symptoms manifesting prior to, during, and post-treatment (Huang & Shi, 2016). These symptoms exert an adverse impact on endocrine response systems, potentially eliciting modifications in the immune system that may influence the recurrence or persistence of the disease (Huang & Shi, 2016; Zhang et al., 2015). Likewise, the presence of anxiety and depression in cancer patients correlates with unfavourable clinical and pathological outcomes (Bagué, 2015).

In a parallel manner, cancer significantly diminishes the quality of life in affected individuals (Lewandowska et al., 2020; Pirri et al., 2013). Within the domain of oncology, the concept of quality of life centres on the holistic well-being of the patient and encompasses the dynamic interplay between their health status and the relationships with the disease and therapeutic interventions (Arraras et al., 2004).

Physical exercise (PE) emerges as a significant adjunctive therapeutic intervention (Azevedo et al., 2013), as it contributes to the enhancement of quality of life (Speck et al., 2010; Tejada-Medina, Franco López, & Ventaja-Cruz, 2020; Wang & Zhou, 2021), improvement in functional capacity (Galvão et al., 2011; Tejada-Medina et al., 2020), alleviation of fatigue (Dimeo et al., 1999; Medeiros Torres, Jorge Koifman, & da Silva Santos, 2022; Meneses-Echavez et al., 2015; Pereira-Rodríguez et al., 2022), mitigation of depression (Fresno-Alba et al., 2023; Segar et al., 1998), reduction in anxiety (Fresno-Alba et al., 2023) and management of arthralgia and peripheral neuropathy (Demark-Wahnefried et al., 2018). Furthermore, a physical exercise (PE) program aids in mitigating the deleterious effects of treatment (Brown et al., 2012), including but not limited to fatigue, loss of muscle mass, cardiotoxicity, diminished maximal oxygen consumption, chemo brain, and psychological repercussions (Blasco & Caballero, 2019).

Conversely, individuals who have survived cancer commonly exhibit residual effects, including fatigue (Barsevick, Whitmer, & Walker, 2001; Hofman et al., 2007;

Vázquez Esseso, 2021), chemo brain (López-Santiago, Cruzado, & Feliú, 2011), apprehension regarding recurrence (Jefford et al., 2008; Vázquez Esseso, 2021), anxiety (Jefford et al., 2008; Mitchell et al., 2013), depression (Baden et al., 2020; Jefford et al., 2008) and pain (Baden et al., 2020). Likewise, they are susceptible to experiencing psychological disorders during the transitional phase following the disease (Hoffman et al., 2009). Conversely, the presence of depression has been noted to correlate with an elevated risk of cancer recurrence (Mallet et al., 2018).

PE confers numerous advantages to cancer survivors, including enhancements in quality of life (May et al., 2009), reduced levels of depression (Marker et al., 2018; Patsou et al., 2018; Salam et al., 2022) and anxiety (Patsou et al., 2018). Additionally, it contributes to diminished levels of fatigue (Marker et al., 2018; Van Weert et al., 2010).

Despite awareness of the advantages of engaging in physical exercise (PE) for both cancer patients and survivors, a substantial number of individuals refrain from participating. Barriers to PE adherence encompass interpersonal, individual, community-institutional factors, as well as time-related obligations (Vargas Kostiuk, 2016).

Limited physical activity levels are associated with factors such as perceptions of the disease, treatment sequelae, and psychological functioning (Uclés & Espinoza, 2017). Similarly, there exists a deficiency in understanding the safety of post-cancer physical exercise (Giles-Corti & Donovan, 2002) as well as a gap in knowledge regarding the preventive potential of physical exercise for cancer, survival, and disease prognosis (Basen-Engquist et al., 2017). Likewise, certain patients exhibit a propensity to reduce their levels of physical activity subsequent to receiving a cancer diagnosis (Moros et al., 2010). The decline in physical activity levels may be linked to the type of treatment undergone, with patients who undergo surgical treatment associated with chemotherapy and radiotherapy experiencing a greater reduction compared to those receiving only chemotherapy or radiotherapy (Valenti et al., 2008). Alternatively, it could be due to apprehension about engaging in physical exercise without supervision (Arietaleanizbeaskoa et al., 2022). Likewise, the confluence of diverse treatment-related side effects frequently impedes individuals from engaging in physical exercise (Clifford et al., 2018; Ness et al., 2006). Given the established scientific evidence highlighting the advantages of physical exercise (PE) in cancer patients and survivors, this study aims to investigate the potential relationship between variables such as quality of life,

fatigue, depression, and anxiety, contingent upon engagement in PE—categorized as active or moderately active—versus non-engagement in PE, characterized as insufficiently active or sedentary. Additionally, the study seeks to identify barriers justifying physical inactivity within this population.

Research Objectives

The research article delineates the impact of cancer on patients and survivors across various variables such as quality of life, fatigue, anxiety, and depression. It also underscores the significance of PE in influencing these variables. Additionally, the article elucidates the barriers faced by this population, hindering the practice of PE.

This article is structured into four sections. The introductory segment delineates the significance of PE across various variables. The second section outlines the methodology employed in conducting the study, while the third section presents the identified results. The fourth section entails a discussion comparing our study's findings with extant scientific literature. The concluding section summarizes the discovered findings and suggests future avenues for research.

Research Methodology

Material and Methods

This research adheres to the principles outlined in the Declaration of Helsinki and has received approval from the Ethics Committee of the European University of the Atlantic under the code CEI-13/2023.

This study employed a quantitative, descriptive, and cross-sectional methodology, involving the administration of a questionnaire at the Spanish Association Against Cancer (AECC) of Cantabria. Recruitment of cancer patients and survivors took place between February and April 2023 through a voluntary online form distributed via the association's communication channels. The inclusion criteria for study participation encompassed individuals aged 18 years and above with a current or past cancer diagnosis. Exclusion criteria included individuals with severe cognitive impairment or significant psychiatric disorders.

Variables and Instruments

Data were gathered using an online questionnaire created with Google Forms and disseminated through a communication channel of the AECC of Cantabria, inviting individuals to participate in the study. Prior to participation, participants were briefed on the study's objectives and assured of the confidentiality

of their data. The ultimate sample size comprised 34 individuals.

The questionnaire assessed various variables, including levels of physical exercise (PE) using the Godin-Shepard Leisure-Time Physical Activity Questionnaire, quality of life through the EORTC QLQ-C30 questionnaire, fatigue utilizing the Fatigue Assessment Questionnaire (FAQ), symptoms of depression employing the Beck Depression Inventory (BDI-II), symptoms of anxiety utilizing the Beck Anxiety Inventory (BAI), and a questionnaire on barriers associated with physical activity conducted by [Vargas Kostiuk \(2016\)](#).

Analysis of Data

The acquired data were systematically arranged in a statistical package, Jamovi 2.3.21 for Windows. Prior to analysis, normal distribution and homogeneity were assessed for all data using the Shapiro-Wilk test, confirming their suitability for subsequent parametric testing. An independent t-test was conducted to investigate intergroup differences (non-PE and PE-engaged individuals) concerning parametric variables such as patient depression and anxiety. For the remaining variables encompassing fatigue and quality of life in both patients and survivors, as well as anxiety and depression in patients, along with all examined barriers in both populations, the Wilcoxon test was employed. Descriptive statistics for various variables were presented in terms of means (m) and standard deviations (sd). Additionally, the predetermined significance level was established at $p < 0.05$.

Results

As illustrated in [Table 1](#), breast cancer emerged as the most prevalent type, constituting 47.3% of cases among patients and 66.6% among survivors. For patients, lung cancer ranked as the second most common, succeeded by non-Hodgkin's lymphomas, accounting for 10.5% of patients and 13.3% of survivors.

Regarding PE levels, three distinct groups were identified: the active group, comprising 10.5% of patients and 14.3% of survivors; the moderately active group, accounting for 21% of patients and 28.6% of survivors; and the insufficiently active or sedentary group, representing 52.6% of patients and 57.1% of survivors.

Concerning the predominant symptoms, a majority of patients exhibited fatigue (53.3%), joint pain (53.3%), and pain (40.0%), while survivors predominantly experienced fatigue (68.4%), joint pain (63.1%), and less frequently, pain (26.3%).

Table 1*Descriptive Analysis of Sociodemographic and Clinical Characteristics.*

	Patients	Survivors
Age	53.3±8.43	52.7±10.7
Sex		
Woman	78.9%	93.3%
Man	21.1%	6.7%
Cancer type		
Breast	47.3%	66.6%
Lung	21.0%	
Non-Hodgkin's lymphoma	10.5%	13.3%
PE level		
Active	10.5%	14.3%
Moderately active	21.0%	28.6%
Insufficiently active/ Sedentary	52.6%	57.1%
Most frequent symptom/s		
Fatigue	53.3%	68.4%
Joint pain	53.3%	63.1%
Pain	40.0%	26.3%

As presented in [Table 2](#), the outcomes of the variables—*anxiety, depression, fatigue, and quality of life*—were analysed based on the engagement in physical exercise (PE) (active or moderately active) or non-engagement (insufficiently active or sedentary individuals). Significant distinctions were observed when comparing the overall scores of various questionnaires between patients who participated in PE and those who did not,

specifically for the variables: Beck Anxiety Inventory (BAI) ($p < 0.001$), Beck Depression Inventory-II (BDI-II) ($p = 0.002$), quality of life ($p < 0.001$), and fatigue ($p < 0.001$). Regarding anxiety, elevated values were noted in patients who did not engage in PE (17.1 vs. 21.7), as well as in the depression questionnaire (16.2 vs. 23.2). Similarly, elevated scores were noted in the quality of life among patients engaged in PE (36.3 vs. 35.6). Conversely, individuals abstaining from PE exhibited lower levels of fatigue (33.1 vs. 31.9) compared to their PE-engaged counterparts. Consequently, patients undertaking PE demonstrated significantly diminished values in anxiety and depression variables, coupled with heightened scores concerning quality of life.

Similarly, notable disparities were identified between survivors who engaged in physical exercise (PE) and those who did not, evidenced by significant differences in the variables: Beck Anxiety Inventory (BAI) ($p < 0.001$), Beck Depression Inventory-II (BDI-II) ($p < 0.001$), quality of life ($p < 0.001$), and fatigue ($p < 0.001$). The scores obtained in the distinct questionnaires were higher for depression (17.3 vs. 22.4) and anxiety (17.3 vs. 22.4) among survivors refraining from PE. Contrastingly, survivors abstaining from physical exercise (PE) displayed diminished fatigue scores (30.9 vs. 29.6) and elevated quality of life scores (29.3 vs. 31.9). Hence, this study demonstrates that survivors engaged in PE exhibit notably lower values concerning depression and anxiety.

Table 2*Variables Associated with Physical Exercise and their Statistical Significance.*

	Anxiety		Depression		Quality of life		Fatigue		
	m (sd)	p	m (sd)	p	m (sd)	p	m (sd)	p	
Patients	PE YES	17,1 (16,5)	$p < 0,001^{**}$	16,2 (10,9)	$p = 0,002^*$	36,3 (6,56)	$p < 0,001^{**}$	33,1 (15,3)	$p < 0,001^{**}$
	PE NO	21,7 (12,6)		23,2 (11,4)		35,6 (14,7)		31,9 (17,8)	
Survivors	PE YES	14,1 (16,9)	$p < 0,001^{**}$	17,3 (12,3)	$p < 0,001^{**}$	29,3 (15,7)	$p < 0,001^{**}$	30,9 (14,4)	$p < 0,001^{**}$
	PE NO	17,3 (9,84)		22,4 (13,0)		31,9 (7,06)		29,6 (16,9)	

*The difference in means is significant at the .05 level.

**The difference in means is significant at the .01 level.

In the PE non-engagement groups ([Table 3](#)), a comparison of barriers hindering PE performance between patients and survivors revealed significant differences in the total scores of various scales: individual barriers ($p < 0.001$), interpersonal ($p = 0.002$), community-institutional ($p = 0.001$), and time-obligations ($p = 0.002$). Notably, survivors exhibited higher values in interpersonal barriers (1.5 vs. 1.88), community-

institutional barriers (3.7 vs. 4.13), and obligations-time barriers (1.4 vs. 4.25). Nonetheless, patients exhibited a higher mean score concerning individual barriers (6.4 vs. 3.88). The comparative analysis across the four scales reveals a discernible pattern of more pronounced and significant barriers limiting PE practice among cancer survivors, except for the individual scale where cancer patients encounter greater difficulties.

Table 3

Barriers that Limit the Practice of Physical Exercise in Inactive Patients and Survivors.

	Patients	Survivors	p
	m (sd)	m (sd)	
Personal barriers	6,40 (1,65)	3,88 (3,09)	p<0,001**
Interpersonal Barriers	1,5 (2,07)	1,88 (1,36)	p=0,002*
Community-Institutional Barriers	3,7 (4,42)	4,13 (4,09)	p=0,001*
Obligations-Time Barriers	1,4 (1,78)	4,25 (3,11)	p=0,002*

*The difference in means is significant at the .05 level.

**The difference in means is significant at the .01 level.

Discussion

The objective of this study is to assess the impact of PE on anxiety, depression, quality of life, and fatigue in both cancer patients and survivors, alongside an examination of the barriers that contribute to physical inactivity within this population.

This study reveals the impact of PE on the quality of life of cancer patients, indicating significant differences between those engaging in PE and those who do not, with the former demonstrating higher scores. These findings align with prior studies that have documented enhancements in quality of life following a 12-week training protocol for women with breast cancer, incorporating aerobic, strength, and stretching exercises in each session (Casla-Barrío et al., 2012). A more targeted investigation conducted among breast cancer patients undergoing chemotherapy found a significant increase in quality of life following a 12-week strength training protocol compared to aerobic training, both executed at a moderate intensity (Schmidt et al., 2015).

Similarly, notable distinctions are evident concerning the engagement in PE and its impact on depression in cancer patients, with those participating in PE exhibiting a lower mean score. Consistent with other research, a 10-week PE training protocol (Mehnert et al., 2011) has been associated with a decrease in depression levels. Similarly, Casla-Barrío et al. (2012) achieved analogous outcomes following a 12-week training regimen that incorporated a combination of strength, aerobic, and stretching exercises in each session.

Similarly, notable distinctions were identified in the overall score of anxiety levels between patients engaging in PE and those who do not, with the latter exhibiting higher scores. This aligns with findings from other studies indicating a reduction in anxiety levels following a 12-week PE

program (Mehnert et al., 2011). Moreover, in the investigation conducted by Bozal et al. (2017), it was discerned, through semi-structured interviews, that women with breast cancer engaging in physical exercise (PE) exhibit diminished levels of anxiety.

Concerning fatigue, individuals abstaining from PE demonstrated a lower mean score. Nonetheless, other researchers have corroborated that PE diminishes fatigue levels in cancer patients (Medeiros Torres et al., 2022; Tomlinson et al., 2014). Specialized investigations propose the implementation of aerobic exercise for patients undergoing chemotherapy as a strategy to alleviate fatigue levels (Dimeo et al., 1999). For instance, Velthuis et al. (2010) concurs that resistance training markedly diminishes fatigue levels in patients undergoing treatment for breast and colon cancer.

Our findings demonstrate a discernible impact of PE on depression levels in cancer survivors, evidenced by lower mean scores among those engaging in PE compared to those who do not participate in PE. These findings align with the observations of other researchers, such as Segar et al. (1998), who noted improvements in depression levels among breast cancer survivors following a 10-week aerobic physical exercise program conducted four days a week.

In accordance with Burgess et al. (2005) anxiety is linked to concerns about mortality, uncertainty regarding the future, illness, and treatments. In our study, we identified noteworthy differences in anxiety among cancer survivors, revealing a correlation with engagement in PE, as survivors participating in PE exhibited lower mean scores. Likewise, in the investigation by Götze et al. (2020) it was noted that long-term cancer survivors (5 and 10 years post-diagnosis) exhibit moderate to severe levels of anxiety. Conversely, Segar et al. (1998) observed a reduction in anxiety among female breast cancer survivors following a 10-week aerobic physical exercise training protocol conducted four days a week. Similarly, the association between anxiety and the engagement in PE among breast cancer survivors was substantiated in another descriptive study (Díaz Fonte & Casla-Barrío, 2022).

In relation to the levels of fatigue in cancer survivors, our data shows a lower average score Regarding fatigue levels in cancer survivors, our data reveals a lower mean score among survivors not engaging in PE. This contradicts the findings of Van Weert et al. (2010) who observed improvements in fatigue levels through a PE program, as opposed to cognitive-behavioural therapy, which showed no additional benefits. Other researchers suggest implementing combined training (resistance and strength training), achieving significant reductions in fatigue levels (Milne et al., 2008).

Similarly, we identified noteworthy disparities in the quality of life based on the engagement in PE, with inactive survivors demonstrating a higher mean score. Nonetheless, other researchers reported an enhancement in the quality of life among cancer survivors following a 12-week supervised exercise training protocol, incorporating both aerobic and resistance exercises three times a week (Mutrie et al., 2007). Similarly, Milne et al. (2008) noted an improvement in quality of life following a 12-week combined training regimen (aerobic and strength) conducted three times a week. Conversely, Bekhet et al. (2019) in a systematic review, demonstrated the association between aerobic exercise and enhancements in the quality of life among female breast cancer survivors. Similarly, the meta-analysis conducted by Fong et al. (2012) revealed the positive impact of physical exercise on quality of life, leading to improvements.

Finally, notable distinctions were identified in the various categories of barriers (individual, interpersonal, community-institutional, and time-obligations) hindering PE when comparing patients with survivors. Specifically, survivors exhibited higher scores in interpersonal, community-institutional, and time-obligations barriers, which are associated with caregiving responsibilities, availability of facilities for PE, absence of preferred activities, and challenges related to time constraints or other obligations impeding the engagement in PE. Likewise, Díaz Fonte and Casla-Barrio (2022) linked individual, community, and obligation-related barriers to PE in women survivors of breast cancer. However, our findings indicate that patients exhibit a higher mean score in individual barriers, encompassing factors such as fatigue, lack of habit, dissatisfaction with sports practice, and apathy towards engagement in physical exercise. Similarly, another study delineated that certain barriers restricting physical activity in cancer patients are associated with physical symptoms

(e.g., vomiting and nausea), their personal circumstances, aesthetic sequelae resulting from treatments, and motivational barriers or a lack of interest in engaging in physical exercise (Ramirez Parada et al., 2017).

Conclusion

In summary, the outcomes of the current study enable the correlation of PE with quality of life, anxiety, depression, and fatigue in both cancer patients and survivors. Our findings indicate that patients engaging in PE exhibit significantly lower values in anxiety and depression variables, along with higher scores in quality of life. Similarly, the study reveals that survivors participating in PE display significantly lower values in relation to depression and anxiety.

Moreover, individuals abstaining from engaging in physical exercise encounter barriers of personal, community-institutional, interpersonal, and time-obligation nature. Among these constraints, survivors demonstrate higher scores across all scales, except for personal barriers, where patients exhibit higher scores. These findings align with the patterns observed in comparable studies, suggesting that the engagement in physical exercise could be justified as an effective intervention for enhancing psychological well-being in both cancer patients and survivors.

On the contrary, the primary limitation of the study pertained to the sample size, as the intended number of participants could not be achieved due to the physical and psychological constraints inherent in this population. These challenges, in turn, hindered the administration of the questionnaire.

In future investigations, it could be valuable to explore the relationship between various variables based on the type of PE undertaken.

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