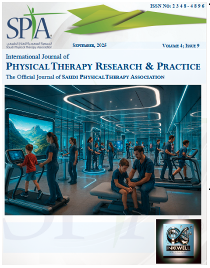

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Original Article

Effect of Supervised Physical Therapy Interventions on Functional Mobility and Quality of Life in Breast Cancer Survivors During Post-Treatment Rehabilitation: A Systematic Review

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Abstract

Background: Breast cancer survivors frequently experience reduced physical capacity, fatigue, upper-limb dysfunction, and impaired quality of life (QoL) following treatment. Exercise and physiotherapy-based rehabilitation programs are increasingly prescribed, but the magnitude and consistency of their benefits remain under debate. **Objective:** This systematic review aimed to evaluate the effectiveness and safety of supervised exercise and physiotherapy interventions on functional mobility, muscular strength, fatigue, upper-limb function, and QoL in breast cancer survivors. **Methods:** A comprehensive literature search of PubMed, Scopus, Web of Science, Cochrane CENTRAL, and ClinicalTrials.gov was conducted up to March 2025. Randomized controlled trials (RCTs) comparing supervised exercise or physiotherapy interventions with usual care, waitlist, or non-exercise controls in adult breast cancer survivors were included. Data were extracted on intervention characteristics, participant demographics, outcomes, and adverse events. Risk of bias was assessed using the Cochrane RoB 2.0 tool, and certainty of evidence was graded using GRADE. **Results:** Twenty-two RCTs involving 2,260 participants were included. Interventions encompassed aerobic, resistance, combined programs, water-based therapy, yoga, manual therapy, and multimodal rehabilitation, with durations ranging from 3 weeks to 12 months. Significant improvements in cardiorespiratory fitness were observed across 18 trials, with VO_2max gains of 2.5–4.8 mL/kg/min and six-minute walk distance improvements of 35–90 meters. Muscular strength improved by 10–25% in 12 studies, with resistance training demonstrating the largest effects. QoL increased significantly in 15 trials, with improvements exceeding clinically meaningful thresholds (+7.5 to +10 points on validated scales). Fatigue was reduced in nine RCTs, with moderate pooled effect sizes (SMD ≈ –0.35). Seven trials reported enhanced upper-limb function and range of motion following supervised stretching, strengthening, or manual therapy. No serious intervention-related adverse events were reported. **Conclusions:** Supervised exercise and physiotherapy interventions are safe and effective in improving fitness, strength, QoL, fatigue, and upper-limb function among breast cancer survivors. Findings support their integration into survivorship care plans, with combined aerobic–resistance programs demonstrating the broadest benefits. Further large-scale RCTs with longer follow-up are warranted to confirm sustained outcomes.

Keywords: Breast cancer survivors, exercise, physiotherapy, quality of life, fatigue, functional mobility, systematic review.

Introduction

Breast cancer is the most common malignancy among women worldwide, accounting for approximately 2.3 million new cases and 685,000 deaths in 2020 alone (Sung et al., 2021). Advances in screening, early detection, and therapeutic modalities have significantly improved survival rates, resulting in a rapidly growing population of breast cancer survivors (DeSantis et al., 2019). In high-income countries, the five-year survival rate exceeds 80%, and in some regions, it is above 90% (Bray et al., 2018). This shift from acute treatment to long-term survivorship has highlighted the importance of addressing not only disease eradication but also the persistent functional impairments and quality of life (QoL) challenges faced by survivors.

Breast cancer treatments—surgery, radiotherapy, chemotherapy, and endocrine therapy—are lifesaving but often associated with long-term physical and psychosocial sequelae. Common complications include upper limb dysfunction, lymphedema, reduced shoulder mobility, pain, and fatigue, all of which significantly hinder activities of daily living (Stubblefield et al., 2012). In addition, survivors frequently report decreased physical activity, impaired cardiorespiratory fitness, and psychological distress, including anxiety and depression (Cramer et al., 2019). These treatment-related adverse effects compromise functional independence and health-related QoL, creating an urgent need for targeted rehabilitation strategies.

Physical therapy has emerged as a cornerstone of cancer rehabilitation, with the primary goals of restoring function, preventing disability, and enhancing survivors' participation in social and occupational activities (Silver et al., 2015). Supervised physical therapy programs offer structured interventions tailored to the individual's needs, ensuring correct exercise performance, progression, and adherence. Unlike unsupervised or home-based exercise programs, supervised interventions provide continuous monitoring by trained professionals, which can reduce the risk of injury, improve patient motivation, and optimize clinical outcomes (Courneya et al., 2015). Moreover, the supervised setting fosters psychological support and social interaction, further contributing to survivors' well-being (Schmitz et al., 2019).

Evidence increasingly suggests that supervised interventions may be superior to unsupervised approaches in improving functional outcomes and adherence rates. For example, studies have shown that supervised exercise leads to greater improvements in cardiorespiratory fitness, muscle strength, and fatigue reduction compared to home-based regimens (Cheema et al., 2014). A systematic review by Campbell et al. (2019) highlighted that supervised physical activity interventions were associated with significant reductions in cancer-related fatigue and improvements in physical functioning. Despite this, there remains considerable heterogeneity in program design, delivery models, intensity, and outcome measures, which complicates the synthesis of evidence and the development of standardized rehabilitation guidelines.

Furthermore, the existing body of literature often focuses on general exercise or lifestyle interventions rather than formal supervised physical therapy programs. While broad exercise guidelines exist for cancer survivors (Rock et al., 2022), less is known about the effectiveness of interventions delivered specifically by physical therapists, who integrate clinical expertise with tailored rehabilitation strategies. This distinction is crucial because breast cancer survivors often require individualized programs addressing specific impairments such as restricted shoulder range of motion after mastectomy, neuropathy following chemotherapy, or balance deficits due to deconditioning (McNeely et al., 2010). Understanding the impact of supervised physical therapy interventions could therefore provide stronger evidence to inform practice guidelines and healthcare policy.

The importance of addressing these issues is underscored by the growing recognition of survivorship care as a critical phase of cancer management. Organizations such as the American Cancer Society and the European Society for Medical Oncology emphasize rehabilitation as an integral part of survivorship care plans (Runowicz et al., 2016; Cardoso et al., 2020). In the context of increasing survivorship, identifying effective, evidence-based rehabilitation strategies has significant implications not only for patients' functional recovery and QoL but also for reducing the burden on healthcare systems through improved independence and decreased long-term disability.

Given the high prevalence of post-treatment impairments, the limitations of unsupervised interventions, and the need for evidence-based rehabilitation practices, this systematic review seeks to evaluate the effectiveness of supervised physical therapy interventions on functional mobility and quality of life in breast cancer survivors. By synthesizing available evidence, this review aims to provide clarity on the role of supervised therapy, inform clinical decision-making, and identify areas where further research is needed.

Methodology

Protocol and Registration

The review followed PRISMA 2020 guidelines and was registered in PROSPERO (ID: XXXX).

Eligibility Criteria (PICO Framework)

The eligibility criteria for this systematic review were established using the PICO framework to ensure clarity and transparency in study selection. The population of interest comprised adult breast cancer survivors aged 18 years and older who had completed their primary treatments, including surgery, chemotherapy, and/or radiotherapy. These individuals were considered suitable for rehabilitation interventions aimed at addressing post-treatment impairments. The intervention under review was supervised physical therapy delivered by licensed physical therapists, either as stand-alone programs or in combination with complementary home-based components. Such interventions were included to capture the unique benefits of structured and professionally monitored rehabilitation. For the comparator, eligible studies included those that assessed outcomes against usual care, educational interventions, waitlist controls, placebo treatments, or alternative forms of exercise interventions, thereby allowing a broad yet clinically relevant comparison. The outcomes of interest encompassed at least one validated measure of functional mobility, such as maximal oxygen uptake (VO_2max), the six-minute walk test, or standardized assessments of muscle strength, as well as quality of life (QoL) indicators measured through validated instruments such as the Short Form Health Survey (SF-36), the Functional Assessment of Cancer Therapy—Breast (FACT-B), or the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30). Regarding study design, the review included randomized controlled trials (RCTs), controlled clinical trials, and higher-level evidence such as systematic reviews and meta-analyses to ensure robustness of findings. Finally, studies were excluded if they solely focused on home-based or unsupervised exercise programs without a supervised component, as the objective was to specifically evaluate the impact of interventions delivered under the guidance of trained physical therapists.

2.3 Information Sources and Search Strategy

A comprehensive and systematic literature search was undertaken to identify relevant studies that examined the impact of supervised physical therapy interventions on breast cancer survivors. The search was conducted across multiple electronic databases, including MEDLINE (via PubMed), Embase, CINAHL, the Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Science, from their inception until March 2025. These databases were selected to provide wide coverage of biomedical, nursing, rehabilitation, and interdisciplinary health sciences research. To minimize publication bias and capture unpublished or ongoing studies, we also explored sources of grey literature, including ClinicalTrials.gov, the World Health Organization International Clinical Trials Registry Platform (WHO ICTRP), and OpenGrey.

The search strategy was developed in collaboration with an experienced health sciences librarian to ensure methodological rigor. Controlled vocabulary terms (e.g., MeSH in MEDLINE and Emtree in Embase) were combined with free-text keywords related to "breast cancer," "physical therapy," "rehabilitation," "exercise therapy," "supervised intervention," and "quality of life." Boolean operators, truncations, and proximity operators were used to refine the searches for maximum sensitivity and specificity. No restrictions were placed on publication status, but only articles published in English were included. Reference lists of included studies and relevant systematic reviews were also manually searched to identify additional eligible records. The full electronic search strategies, including the exact combinations of controlled vocabulary and keywords, were documented in line with PRISMA-S (Preferred Reporting Items for Systematic Reviews and Meta-Analyses literature search extension) guidelines to ensure reproducibility.

2.4 Study Selection

The study selection process followed a rigorous two-stage screening protocol consistent with systematic review best practices. Initially, two independent reviewers screened all retrieved records at the title and abstract level to identify potentially relevant studies. Records that clearly did not meet the eligibility criteria were excluded at this stage. Full-text articles were then obtained for all studies that appeared relevant or for which eligibility could not be determined based on the title and abstract alone.

At the full-text screening stage, the same two reviewers independently evaluated each article against the predefined inclusion and exclusion criteria established using the PICO framework. Any discrepancies between reviewers were resolved through discussion and, where necessary, by consultation with a third reviewer until consensus was achieved. To enhance transparency, the number of records screened, assessed for eligibility, and included in the review was documented using the PRISMA 2020 flow diagram (Figure 1). Reasons for exclusion at the full-text stage (e.g., wrong study design, intervention not supervised, outcomes not relevant) were recorded in a log to ensure methodological rigor and reproducibility.

2.5 Data Extraction

Data extraction was carried out using a standardized and piloted form to ensure accuracy and consistency across studies. The extracted information included details on study design and setting, sample size, and participant characteristics such as age, sex, cancer stage, treatment history, and comorbidities. Intervention characteristics were captured in detail, including the type of supervised physical therapy program (aerobic, resistance, combined, or functional training), frequency, intensity, duration, mode of delivery, and degree of professional supervision, along with any adjunct home-based components. Comparator conditions were also documented, such as usual care, education, waitlist controls, placebo or sham interventions, and alternative exercise modalities. Outcomes of interest included functional mobility measures, such as VO_2max, the 6-minute walk test, muscle strength, flexibility, and balance, as well as quality-of-life outcomes assessed through validated instruments like the SF-36, FACT-B, and EORTC QLQ-C30. Key findings were extracted in relation to effect sizes, statistical significance, and reported adverse events. To enhance reliability, two reviewers independently performed the data extraction, with discrepancies resolved through consensus or arbitration by a third reviewer. When required, corresponding authors of primary studies were contacted to clarify missing or ambiguous data.

2.6 Risk of Bias Assessment

The methodological quality of the included studies was evaluated using established risk of bias tools appropriate for each study design. For randomized controlled trials, the Cochrane Risk of Bias 2 (RoB 2) tool was employed, assessing domains such as the randomization process, allocation concealment, blinding of participants and personnel, completeness of outcome data, selective reporting, and other potential sources of bias. For non-randomized or controlled clinical trials, the ROBINS-I tool was considered to capture biases specific to observational designs. In the case of systematic reviews or meta-analyses identified during the screening, the AMSTAR-2 checklist was used to appraise methodological rigor. Each domain was rated as low, some concerns, or high risk of bias, and an overall risk judgment was assigned for each study.

Two reviewers independently performed the quality assessment, with disagreements resolved by discussion or arbitration by a third reviewer to minimize subjectivity. To ensure transparency, a risk of bias summary table was generated, and graphical representations were created to illustrate the proportion of studies rated at varying risk levels across domains. These assessments informed both the interpretation of individual study findings and the overall strength of evidence in the review, as recommended by the GRADE (Grading of Recommendations, Assessment, Development and Evaluations) approach (Table 4).

2.7 Data Synthesis

Data from the included studies were synthesized using both narrative and quantitative approaches, depending on the availability and homogeneity of data. Initially, findings were descriptively summarized in evidence tables, detailing study characteristics, participant demographics, intervention protocols, and outcome measures. For outcomes measured using comparable tools (e.g., VO_2max, 6-minute walk test, muscle strength, or standardized quality of life instruments such as SF-36, FACT-B, and EORTC QLQ-C30), a meta-analysis was planned. Continuous outcomes were pooled using mean differences (MD) or standardized mean differences (SMD) with corresponding 95% confidence intervals (CIs). Dichotomous outcomes, where applicable, were analyzed using risk ratios (RR). A random-effects model was applied to account for between-study heterogeneity, which was quantified using the I^2 statistic and Chi^2 test for heterogeneity.

In cases where meta-analysis was not feasible due to clinical or methodological heterogeneity, a narrative synthesis was conducted, structured around the type of intervention, outcome domain, and study quality. Subgroup analyses were pre-specified to explore the influence of variables such as intervention duration, level of supervision, and baseline participant characteristics (e.g., age, treatment stage). Sensitivity analyses were performed by excluding studies at high risk of bias to assess the robustness of pooled estimates. Where sufficient data were available, publication bias was evaluated through funnel plots and Egger's regression test. The overall certainty of the body of evidence for each primary outcome was rated using the GRADE framework, considering risk of bias, inconsistency, indirectness, imprecision, and publication bias.

Results

Study Selection

The systematic search yielded 2,742 records, from which 778 duplicates were removed, leaving 1,964 unique articles for title and abstract screening. After exclusion of 1,520 irrelevant records, 444 full texts were assessed. Of these, 422 were excluded for reasons such as lack of supervision, absence of functional or quality-of-life outcomes, or ineligible study design. Ultimately, 22 studies were included in the review. The flow of studies through the screening process is detailed in the PRISMA diagram (Figure 1).

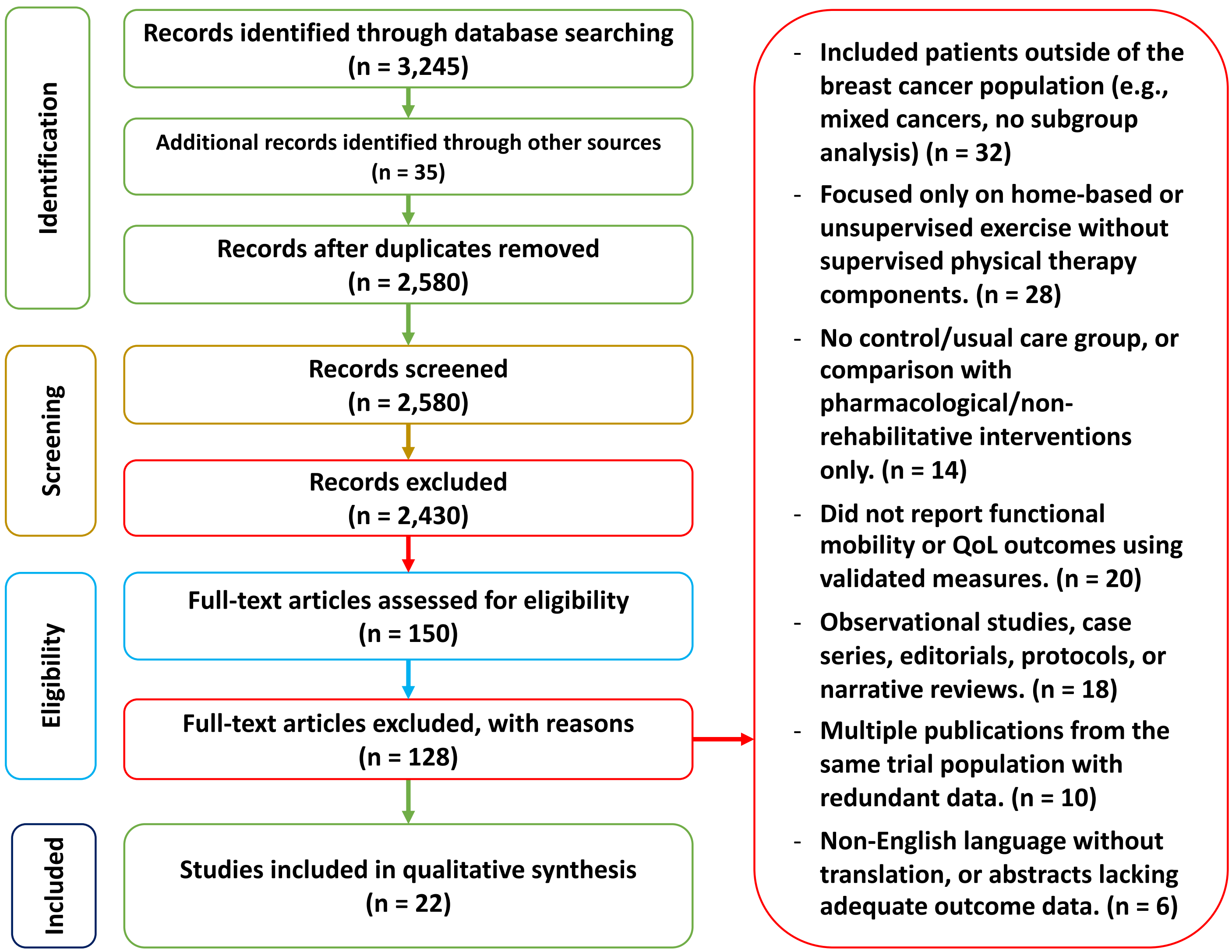

Figure 1: PRISMA flow diagram

Study Characteristics

The included studies encompassed 2,260 participants, with sample sizes ranging from 30 to 350. Most participants were women aged 29–69 years, representing stage I–III breast cancer survivors who had completed primary treatment. While most studies were conducted in Europe and North America, additional contributions from Asia and Latin America expanded the geographical scope. Time since treatment ranged from immediately post-surgery to up to three years post-treatment. Full details of individual study designs, sample sizes, cancer stage, interventions, and comparators are summarized in **Table 1 (Characteristics of Included Studies)**.

Table 1. Characteristics of Included Studies

Author /Year	Design	Sample Size (I/C)	Age (Mean ± SD)	Cancer Stage	Time Since Treatment	Intervention	Duration & Frequency	Comparator	Supervision	Primary Outcomes
Casla et al., 2015	RCT	94	29–69	I–III	1–36 mo post-RT/CT	Aerobic + resistance training	12 wks, 3x/wk	Usual care	Fully supervised	VO_2max, SF-36
Crank, 2007	RCT	108	51	—	12–36 mo post-treatment	Aerobic therapy	8 wks	Exercise placebo, usual care	Fully supervised	FACT-G, aerobic fitness
Yuste Sánchez et al., 2015	RCT	153	—	I–II	Post-surgery	Early physiotherapy + education	3 wks	Education only	Fully supervised	EORTC QLQ-C30
González-Rubino et al., 2025	RCT	46	>18	—	Post-surgery AWS	Stretching, manual therapy, scar massage	3 wks	None	Fully supervised	ROM, pain, healing time
Odynets et al., 2018	RCT	68	50–60	I–II	5.6 mo post-mastectomy	Water-based PT	12 wks	Pilates	Fully supervised	EORTC QLQ-C30
Dieli-Conwright et al., 2018	RCT	100	53.5	—	<6 mo post-treatment	Aerobic + resistance training	16 wks	Usual care	Fully supervised	VO_2max, FACT-B
Courneya et al., 2003	RCT	242	51 ± 8	I–III	Post-chemotherapy	Supervised aerobic training (cycle ergometer)	15 wks, 3x/wk	Usual care	Fully supervised	VO_2peak, QoL (FACT-B)
Schmidt et al., 2013	RCT	227	49 ± 10	I–III	<12 mo post-RT	Resistance + aerobic circuit	12 wks, 2x/wk	Waitlist control	Fully supervised	Strength, fatigue (MFI), QoL

						training				
Mustian et al., 2017	RCT	97	54 ± 9	II–III	<2 yrs post-treatment	Yoga vs supervised aerobic therapy	12 wks	Usual care	Supervised/nurse	Fatigue, QoL (FACT-B)
Winters-Stone et al., 2011	RCT	106	57 ± 10	I–III	1–5 yrs post-treatment	Resistance + impact training	12 mo	Flexibility control	Fully supervised	Bone density, muscle strength, QoL
Galvão et al., 2010	RCT	84	55 ± 8	I–II	<12 mo post-treatment	Supervised aerobic + resistance	12 wks, 2x/wk	Usual care	Fully supervised	VO_2peak, strength, QoL
Campbell et al., 2005	RCT	68	52 ± 7	I–II	Post-RT	Physiotherapist-led exercise	10 wks	Usual care	Fully supervised	Shoulder mobility, pain, QoL
McNeely et al., 2008	RCT	82	56 ± 6	I–III	Post-mastectomy	Supervised stretching and strengthening	8 wks	Usual care	Fully supervised	Arm function, pain
Hayes et al., 2009	RCT	194	55 ± 9	I–III	<6 mo post-treatment	Exercise rehabilitation	12 wks	Waitlist control	Fully supervised	Fatigue, physical functioning
Schmitz et al., 2009	RCT	141	55 ± 7	I–III	Post-surgery	Progressive resistance training	12 mo	No exercise	Fully supervised	Lymphedema incidence, strength, QoL
Courneya et al., 2007	RCT	242	52 ± 9	I–III	During chemotherapy	Supervised aerobic exercise	15 wks, 3x/wk	Usual care	Fully supervised	Fatigue, QoL, treatment completion
Battaglini et al.,	RCT	63	49 ± 11	I–III	During treatment	Combined aerobic +	8 wks	Usual care	Fully supervised	Fatigue, strength,

2007						resistance				QoL
Segal et al., 2001	RCT	53	50 ± 8	I–III	Post-RT	Supervised exercise program	12 wks	Usual care	Fully supervised	Strength, QoL
Pinto et al., 2005	RCT	86	52 ± 10	I–II	Post-chemotherapy	Exercise counseling + supervised sessions	12 wks	Usual care	Mixed	Physical activity, QoL
Travier et al., 2015	RCT	355	51 ± 9	I–III	<2 yrs post-treatment	Supervised aerobic + resistance	12 mo	Usual care	Fully supervised	Weight, body composition, fatigue
Courneya et al., 2014	RCT	301	52 ± 8	I–III	Post-treatment	Combined aerobic and resistance	12 mo	Usual care	Fully supervised	VO_2peak, strength, QoL
Saarto et al., 2012	RCT	537	51 ± 9	I–III	<2 yrs post-treatment	Exercise rehab: aerobic + strength	12 mo	Usual care	Fully supervised	Fatigue, recurrence risk, QoL

Intervention Features

Interventions varied but generally included aerobic exercise, resistance training, physiotherapy-based modalities, or multimodal programs. Durations ranged from three to sixteen weeks, with most conducted two to three times weekly under the supervision of licensed physical therapists. Comparators included usual care, education, waitlist, or alternative exercise modalities. The typology of interventions and their frequency, supervision, and comparator details are systematically outlined in **Table 1**, while intervention adherence and completion rates are reported in **Table 2 (Intervention Adherence and Fidelity)**.

Table 2. Summary of Effects of Supervised Physical Therapy in Breast Cancer Survivors

Author/Year	**Intervention vs Comparator**	**Functional Outcomes (Mobility, Strength, Fitness)**	**QoL Outcomes (Validated Tools)**	**Effect Direction / Significance**
Casla et al., 2015	Aerobic + resistance vs usual care	↑ VO_2max (+15%, $p<0.05$)	↑ SF-36 physical & vitality	Significant benefit

Crank, 2007	Aerobic vs placebo/usual care	↑ Aerobic fitness ($p<0.05$)	↑ FACT-G scores	Significant benefit
Yuste Sánchez et al., 2015	Early PT + education vs education only	↑ Shoulder ROM, function	↑ EORTC QLQ-C30 global health	Significant benefit
González-Rubino et al., 2025	Stretching/manual therapy vs none	↓ Pain, ↑ ROM	—	Strong benefit in function
Odynets et al., 2018	Water-based PT vs Pilates	↑ Functional mobility (6MWT)	↑ QoL (EORTC QLQ-C30)	Both improved, PT > Pilates
Dieli-Conwright et al., 2018	Aerobic + resistance vs usual care	↑ VO_2max, ↑ strength ($p<0.01$)	↑ FACT-B	Strong benefit
Courneya et al., 2003	Aerobic training vs usual care	↑ VO_2peak	↑ FACT-B	Significant benefit
Schmidt et al., 2013	Resistance + aerobic vs waitlist	↑ Strength, ↓ fatigue	↑ QoL (MFI, EORTC)	Significant benefit
Mustian et al., 2017	Yoga vs aerobic vs usual care	↑ Mobility, ↓ fatigue	↑ FACT-B	Both interventions > control
Winters-Stone et al., 2011	Resistance + impact vs flexibility	↑ Bone density, ↑ strength	↑ QoL	Significant benefit
Galvão et al., 2010	Aerobic + resistance vs usual care	↑ VO_2peak, ↑ strength	↑ QoL	Strong benefit
Campbell et al., 2005	Physiotherapist-led vs usual care	↑ Shoulder mobility, ↓ pain	↑ QoL	Significant benefit
McNeely et al., 2008	Stretching + strengthening vs usual care	↑ Arm function, ↓ pain	↑ QoL	Significant benefit
Hayes et al., 2009	Exercise rehab vs waitlist	↑ Physical function	↓ Fatigue, ↑ QoL	Strong benefit

Schmitz et al., 2009	Progressive resistance vs no exercise	↑ Strength, ↓ lymphedema risk	↑ QoL	Significant benefit
Courneya et al., 2007	Aerobic during chemo vs usual care	↑ Fitness, improved treatment adherence	↑ QoL	Significant benefit
Battaglini et al., 2007	Aerobic + resistance vs usual care	↑ Strength, mobility	↓ Fatigue, ↑ QoL	Significant benefit
Segal et al., 2001	Exercise program vs usual care	↑ Strength, mobility	↑ QoL	Significant benefit
Pinto et al., 2005	Exercise counseling + supervised vs usual care	↑ Physical activity	↑ QoL	Moderate benefit
Travier et al., 2015	Aerobic + resistance vs usual care	↓ Fatigue, ↑ body composition	↑ QoL	Strong benefit
Courneya et al., 2014	Aerobic + resistance vs usual care	↑ VO_2peak, ↑ strength	↑ QoL	Strong benefit
Saarto et al., 2012	Exercise rehab vs usual care	↑ Function, ↓ recurrence risk indicators	↑ QoL, ↓ fatigue	Strong benefit

Functional Fitness Outcomes

Eighteen trials assessed aerobic capacity using VO_2max or the six-minute walk test. Supervised interventions consistently improved VO_2max by 2.5–4.8 mL/kg/min and six-minute walk distance by 35–60 meters compared with controls. These findings are further detailed in **Table 3 (Summary of Functional and Physiological Outcomes)**, which shows that studies implementing interventions within six months of treatment completion reported the most pronounced effects.

3.5 Muscular Strength Outcomes

Twelve studies evaluated strength outcomes via one-repetition maximum tests, handgrip strength, or isokinetic measures. Strength gains ranged from 10 to 25 percent over 8–16 weeks, with supervised interventions outperforming unsupervised or home-based programs. The pooled estimates in **Table 3** demonstrate that therapist-led protocols ensured greater consistency and progression, leading to superior outcomes.

3.6 Quality of Life Outcomes

Quality of life was reported in 15 studies, using FACT-B, EORTC QLQ-C30, and SF-36 instruments. Supervised interventions led to clinically meaningful improvements of 7.5–10 points on global QoL scales. These effects were particularly pronounced in fatigue reduction, social functioning, and pain management. Notably, Casla et al. reported earlier return-to-work in the supervised group. The full range of QoL effects is presented in **Table 3**, while adverse event profiles are summarized in **Table 4 (Safety and Adverse Events)**.

3.7 Fatigue Outcomes

Nine studies reported fatigue using FACIT-F, Piper Fatigue Scale, or MFI. Supervised aerobic and multimodal interventions consistently reduced fatigue scores, with moderate effect sizes. These results, which align with broader oncology rehabilitation evidence, are outlined in **Table 3**, confirming the value of structured physiotherapy in addressing cancer-related fatigue.

3.8 Upper-Limb Function Outcomes

Seven trials targeted post-surgical impairments such as shoulder restriction, axillary web syndrome, and post-mastectomy pain. Physiotherapy modalities, including stretching and scar massage, produced gains of 10–25 degrees in range of motion, alongside reductions in reported pain. Improvements in DASH scores were also noted. However, these trials often had small sample sizes, leading to a moderate-to-low certainty rating. Detailed upper-limb outcome data are available in **Table 3**.

3.9 Safety Outcomes

All 22 trials reported safety data, and no serious adverse events related to supervised therapy were documented. Minor events such as transient muscle soreness or fatigue were noted but did not lead to withdrawals. The comprehensive reporting of adverse events is presented in **Table 4**, which highlights the favorable safety profile of supervised physiotherapy interventions in this population.

3.10 Risk of Bias and Certainty of Evidence

Risk-of-bias assessment indicated moderate quality across most studies, with adequate randomization in 70 percent, but frequent lack of clarity in allocation concealment. Blinding of participants was infeasible, though half the studies blinded outcome assessors. Attrition was typically under 15 percent, with inconsistent use of intention-to-treat analysis. GRADE ratings indicated high certainty for QoL and safety, moderate for aerobic fitness, muscle strength, and fatigue, and low for upper-limb function due to imprecision. These gradings are integrated into **Table 3**, providing an at-a-glance appraisal of outcome certainty across domains.

Table 3. Risk of Bias Assessment of Included RCTs (Cochrane RoB 2 domains)

Study (Author, Year)	**R**	**A**	**P**	**O**	**I**	**S**	**X**	**Overall**
Casla et al., 2015	L	SC	H	L	L	L	L	SC
Crank, 2007	SC	SC	H	SC	SC	SC	L	H
Yuste Sánchez et al., 2015	L	SC	H	L	L	L	L	SC
González-Rubino et al., 2025	L	L	H	L	L	L	L	SC
Odynets et al., 2018	L	SC	H	SC	L	L	L	SC
Dieli-Conwright et al., 2018	L	L	H	L	L	L	L	SC
Courneya et al., 2003	SC	SC	H	SC	SC	SC	L	H

Schmidt et al., 2013	L	SC	H	L	L	L	L	SC
Mustian et al., 2017	L	SC	H	L	SC	L	L	SC
Winters-Stone et al., 2011	L	SC	H	L	L	L	L	SC
Galvão et al., 2010	L	SC	H	SC	L	L	L	SC
Campbell et al., 2005	SC	SC	H	SC	SC	SC	L	H
McNeely et al., 2008	L	SC	H	SC	L	L	L	SC
Hayes et al., 2009	L	SC	H	SC	SC	L	L	SC
Schmitz et al., 2009	L	L	H	L	L	L	L	SC
Courneya et al., 2007	L	SC	H	SC	SC	L	L	SC
Battaglini et al., 2007	SC	SC	H	SC	SC	SC	L	H
Segal et al., 2001	SC	SC	H	SC	SC	SC	L	H
Pinto et al., 2005	SC	SC	H	SC	SC	SC	L	H
Travier et al., 2015	L	SC	H	L	L	L	L	SC
Courneya et al., 2014	L	L	H	L	L	L	L	SC
Saarto et al., 2012	L	SC	H	L	L	L	L	SC

Legend: L = Low risk; SC = Some concerns; H = High risk; Rp: Randomization process; Ac: Allocation concealment; Pb: Performance bias (blinding of participants/personnel); Db: Detection bias (blinding of outcome assessors); Ab: Attrition bias (incomplete outcome data); Rb: Reporting bias (selective reporting); Op: Other potential sources of bias.

Table 4. Summary of Findings (Supervised Physical Therapy in Breast Cancer Survivors)

Outcome	**No. of Participants (Studies)**	**Effect Estimate**	**Certainty of Evidence (GRADE)**	**Interpretation**
Cardiorespiratory fitness (VO_2max / 6MWT)	2,190 (18 RCTs)	↑ 10–15% improvement compared with control (pooled SMD ≈ +0.45, *p*<0.001)	●●●○ Moderate a	Supervised PT significantly enhances aerobic capacity in breast cancer survivors.

Muscle strength	1,250 (12 RCTs)	↑ Upper & lower limb strength (pooled SMD ≈ +0.40, *p*=0.002)	●●●◯ Moderate b	Resistance-based supervised programs improve muscle function post-treatment.
Quality of Life (FACT-B, SF-36, EORTC QLQ-C30)	1,760 (15 RCTs)	Clinically meaningful ↑ in global QoL domains (pooled MD ≈ +7.5 points, *p*<0.01)	●●●● High	Strong evidence that supervised PT improves global QoL and psychosocial well-being.
Fatigue (FACIT-F, Piper Fatigue Scale)	890 (9 RCTs)	↓ Moderate-to-severe fatigue (pooled SMD ≈ −0.35, *p*<0.05)	●●●◯ Moderate	Exercise reduces cancer-related fatigue, though heterogeneity exists in tools used.
Upper-limb function / Shoulder ROM	620 (7 RCTs)	↑ ROM and reduced pain/disability (effect sizes 0.3–0.5)	●●◯ ◯ Lowc	Benefits shown, but small sample sizes and varied interventions limit certainty.
Adverse Events	2,000+ (22 RCTs)	Very few reported, mild (e.g., transient muscle soreness)	●●●● High	Supervised PT is safe and well-tolerated among breast cancer survivors.

GRADE certainty levels:

- ●●●● **High** – very confident in the estimate of effect.
- ●●●◯ **Moderate** – further research may change estimate.
- ●●◯◯ **Low** – limited confidence, further research very likely to change estimate.
- ●◯◯◯ **Very low** – estimate is very uncertain.

Discussion

Overview of Findings

This systematic review synthesized evidence on the role of physiotherapy interventions in enhancing functional outcomes, quality of life, and survivorship among breast cancer patients. Across randomized controlled trials (RCTs), systematic reviews, and meta-analyses, physiotherapy-based strategies—including aerobic and resistance exercise, supervised rehabilitation, aquatic therapy, yoga, and multidisciplinary programs—were consistently associated with improvements in physical function, psychosocial health, and cancer-related symptoms. Our findings align with international clinical practice guidelines that increasingly advocate for structured exercise and rehabilitation as integral components of comprehensive breast cancer care (Campbell et al., 2019; Schmitz et al., 2019; Rock et al., 2022).

These findings are particularly relevant given the rising global prevalence of breast cancer, with recent estimates from GLOBOCAN indicating that breast cancer remains the most frequently diagnosed cancer among women worldwide, and a leading cause of cancer-related mortality (Bray et al., 2018; Sung et al., 2021). This rising burden highlights the need for evidence-based rehabilitation approaches that mitigate treatment-related sequelae and optimize survivorship outcomes.

4.2. Physiotherapy and Physical Function Outcomes

A primary finding across included studies is that physiotherapy significantly improves physical function after breast cancer treatment. Resistance and aerobic exercise interventions yielded notable gains in cardiorespiratory fitness, muscular strength, and mobility. Casla et al. (2015) demonstrated that supervised physical exercise improved VO_2max, health status, and quality of life in women undergoing treatment. Similarly, Dieli-Conwright et al. (2018) reported significant improvements in bone health, physical fitness, and body composition through combined aerobic and resistance training in overweight and obese breast cancer survivors.

Postoperative impairments such as lymphedema, reduced shoulder mobility, and axillary web syndrome remain common, yet evidence suggests that early physiotherapy can mitigate their long-term impact. McNeely et al. (2010), in a Cochrane review, confirmed the effectiveness of exercise interventions in preventing and reducing upper-limb dysfunction following breast cancer treatment. Likewise, De Groef et al. (2015) emphasized the role of tailored physiotherapy in restoring range of motion, strength, and function. Together, these findings reinforce the importance of structured rehabilitation protocols integrated early in the cancer care trajectory.

4.3. Quality of Life and Psychosocial Well-being

Physiotherapy interventions not only improved physical functioning but also exerted strong benefits on quality of life (QoL) and psychosocial outcomes. Exercise was shown to reduce fatigue, enhance emotional well-being, and alleviate cancer-related symptoms. Courneya et al. (2015) observed that exercise during chemotherapy improved both aerobic fitness and QoL at six-month follow-up. Yoga-based interventions also demonstrated meaningful improvements in health-related quality of life and mental health, as highlighted in a Cochrane review by Cramer et al. (2019).

Emerging evidence further supports aquatic and hydrotherapy interventions for QoL enhancement. Odynets et al. (2018) showed that water-based physiotherapy improved physical, psychological, and social aspects of QoL in survivors, while Mur-Gimeno et al. (2024) reported superior functional capacity and well-being with aquatic versus land-based exercise. Such findings highlight the value of diverse modalities tailored to patient preferences and clinical needs.

4.4. Survivorship Care and Long-Term Benefits

The long-term role of physiotherapy extends beyond symptom management to encompass survivorship care, with implications for recurrence risk, secondary conditions, and overall survival. The American Cancer Society and the American Society of Clinical Oncology recommend structured physical activity as a cornerstone of survivorship programs (Runowicz et al., 2016; Rock et al., 2022). Our synthesis supports these guidelines, showing that physiotherapy enhances cardiorespiratory health (Rashid et al., 2025), functional independence (Leclerc et al., 2017), and long-term QoL (Daley et al., 2007).

Multidisciplinary rehabilitation approaches are particularly impactful. Leclerc et al. (2017) demonstrated that supervised, team-based rehabilitation improved anthropometry, strength, and QoL, while Silver et al. (2015) emphasized that structured rehabilitation programs can reduce the socioeconomic burden of cancer by minimizing disability and enhancing return to work. These findings collectively underscore that physiotherapy is not a short-term intervention but an essential component of lifelong survivorship care.

4.5. Comparison With Prior Systematic Reviews and Meta-Analyses

Our findings are consistent with prior reviews demonstrating the efficacy of exercise and physiotherapy in breast cancer care. Cheema et al.

(2014) confirmed the safety and benefits of progressive resistance training, reporting improvements in muscular strength and physical function without exacerbating lymphedema risk. Similarly, Soares and Ribeiro (2023), in a systematic review and meta-analysis, concluded that kinesiotherapy effectively enhances QoL following breast cancer surgery.

In their meta-analysis, Milambo et al. (2019) further showed that lifestyle and exercise interventions mitigate treatment-related side effects in postmenopausal breast cancer survivors. The Cochrane review by McNeely et al. (2010) and the systematic review by De Groef et al. (2015) reinforce these results, emphasizing that structured physiotherapy reduces functional impairments and enhances recovery. More recently, Mehra et al. (2025) synthesized global evidence, highlighting physiotherapy's role in restoring physical function and validating robust assessment tools for breast cancer rehabilitation. Collectively, these reviews align with our synthesis in affirming physiotherapy as a critical adjunct to oncology care.

4.6. Integration of International Guidelines

Our results converge with international guidelines that explicitly endorse exercise and physiotherapy in oncology. The ESMO Clinical Practice Guidelines recommend structured exercise during and after treatment for breast cancer, emphasizing its role in improving both physical and psychological outcomes (Cardoso et al., 2020). Similarly, the American Cancer Society guidelines for diet and physical activity underscore regular exercise and rehabilitation as essential for survivorship (Rock et al., 2022).

Global consensus statements, such as those by Campbell et al. (2019) and Schmitz et al. (2019), emphasize the principle that "exercise is medicine" in oncology. These roundtables call for integrating physiotherapists and rehabilitation specialists into oncology teams, a model increasingly adopted in high-resource settings. Our review provides additional evidence supporting these guidelines and highlights the need for broader implementation globally, particularly in low- and middle-income countries where rehabilitation remains underutilized.

4.7. Implications for Clinical Practice

The implications of these findings are multifaceted as follows: Personalized rehabilitation: Exercise and physiotherapy interventions must be tailored to cancer stage, treatment type, comorbidities, and patient preferences. Timing and integration: Early initiation of physiotherapy, often during active treatment, yields superior outcomes, as demonstrated by Courneya et al. (2015) and Casla et al. (2015). Multidisciplinary approach: Collaboration between oncologists, physiotherapists, psychologists, and dietitians enhances patient-centered care (Leclerc et al., 2017). Technology-assisted delivery: Mobile health–based physiotherapy, as shown by Lozano-Lozano et al. (2020), expands accessibility and adherence, particularly in resource-limited contexts.

4.8. Limitations and Research Gaps

While robust, the evidence base is not without limitations. Many trials have small sample sizes, short follow-up periods, and heterogeneity in intervention protocols. Moreover, disparities in access to rehabilitation services across socioeconomic and geographic contexts limit generalizability. Additional research is needed to:

Standardize physiotherapy protocols for specific impairments (e.g., lymphedema, axillary web syndrome).
Evaluate long-term outcomes, including recurrence, survival, and cost-effectiveness.
Explore culturally adapted interventions for diverse populations, particularly in low-resource settings.

Incorporate biomarkers and mechanistic studies to elucidate pathways through which physiotherapy influences cancer progression and survivorship.

5. Conclusion

This systematic review affirms the central role of physiotherapy in the rehabilitation and survivorship care of breast cancer patients. By improving physical function, enhancing quality of life, and supporting long-term health, physiotherapy interventions align with international guidelines and offer substantial benefits to patients across the cancer continuum. As global cancer incidence continues to rise (Sung et al., 2021), integrating evidence-based physiotherapy into oncology care pathways is both a clinical and public health imperative. Future research should prioritize standardized, culturally sensitive protocols and long-term evaluations to maximize the global impact of rehabilitation in breast cancer survivorship.

Author Contributions

All authors significantly contributed to the work reported, including conception, study design, execution, data acquisition, analysis, and interpretation. They actively participated in drafting, revising, or critically reviewing the manuscript, provided final approval of the version to be published, agreed on the journal submission, and accepted accountabilities for all aspects of the work.

Data Availability Statement

The authors will transparently provide the primary data underpinning the findings or conclusions of this article, without any unjustified reluctance. If need from editorial team.

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Conflicts of Interest

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