

Systematic Review

Physical activity and quality of life in breast cancer survivors

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Abstract.

OBJECTIVES: We reviewed the literature on breast cancer patients' physical activity and quality of life. This paper should urge health services and breast cancer survivors to continue appropriate physical activity and assess its advantages.

DESIGN: A systematic review was conducted.

DATA SOURCES: This systematic review used online databases: PubMed, Web of Science, Scopus, and Google Scholar. A search from the beginning of 2018–2024 was conducted.

REVIEW METHOD: Medical Subject Headings (MESH) were used for keyword selection along with other target keywords, such as “Quality of life”, “Breast cancer”, “Chemotherapy”, “Treatment side effects”, “Patient experience”, “Psychosocial well-being”, “Physical functioning”, “Emotional distress”, and “Supportive care”. We reviewed and included all English-language publications. A narrative synthesis was conducted to present the results of the studies.

RESULTS: The search using the keywords yielded a total of 135 studies. Each result was filtered again according to the inclusion and exclusion criteria, resulting in a final total of 15 studies to be included in the systematic review.

CONCLUSION: The evidence supports the benefits of physical activity in enhancing the quality of life for breast cancer survivors, indicating that further prospective and intervention studies are needed.

Keywords: Physical activity, quality of life, breast cancer

1. Introduction

Quality of life (QoL) in breast cancer patients is multifaceted, including health, well-being, and social

aspects. It is critical for understanding the effects of breast cancer, making treatment options, and providing supportive care. Diagnosis, treatment, post-treatment, and survival all impact quality of life. Assessments of health-related quality of life are critical for understanding the impact of breast cancer and designing therapies. Early survivors with higher physical and psychological demands had a lower quality of life, stressing the importance of addressing these needs early in the survivorship stage [1–4].

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Breast cancer patients require comprehensive care for their quality of life, including physical, mental, and social aspects [5]. Monitoring changes in quality of life during treatment is essential for customized interventions. Understanding predictors of quality of life can help healthcare professionals improve health and quality of life [6], while qualitative studies can inform interventions that address specific needs and concerns.

Breast cancer is the most common malignancy worldwide, disproportionately affecting women in low- and middle-income countries. The World Health Organisation's (WHO) Global Breast Cancer Initiative seeks to reduce breast cancer incidence by 2.5% per year, saving 2.5 million lives over 20 years. Key techniques include health promotion, early detection, prompt diagnosis, and comprehensive management [7–9].

The World Health Organisation (WHO) highlights the importance of quality of life (QoL) for breast cancer patients, focusing on emotional, social, and role functioning. Symptoms such as fatigue, sleeplessness, and pain majorly impact these areas. The WHO Global Breast Cancer Initiative seeks to improve survivors' quality of life by addressing the needs of patients, families, and communities [10,11].

Optimizing breast cancer survivorship care requires QoL research. Health-related QoL indicators affect survival rates. Studies have shown that poor HRQoL increases mortality risk, underscoring the need for focused survival care [12].

Physical activity improves breast cancer patients' and survivors' quality of life (QoL) by influencing their independence and health status [13]. The American College of Sports Medicine (ACSM) and the United States Department of Health and Human Services recommend exercise training for chronic diseases such as cancer patients. However, only 28% of survivors meet the recommended activity levels, emphasizing the importance of supporting and encouraging physical activity appropriate to their condition [14,15].

Physical activity is critical for breast cancer survivors to improve their quality of life since it reduces symptoms of melancholy, anxiety, and despair while also improving bodily function, highlighting the importance of continued study and intervention development [16,17].

The review emphasizes self-efficacy and health status in analyzing the association between physical exercise and QOL in breast cancer survivors. Future research should examine other psychosocial dimensions linked with health status, such as self-esteem,

depression, functional limitations, and cognitive function, as well as biological mediators [18]. The study also emphasizes the need for studies to determine the optimal time along the breast cancer continuum to intervene to maximize the QOL benefits of a physical activity program [19].

In addition, a study examines demographic trends in the country, notably the aging breast cancer survivors and their distinct physical, social, and psychological health needs. As breast cancer survivors rise due to early detection and treatment, this is significant [20].

A review suggests that self-efficacy and health status markers help explain how physical activity affects global QOL in breast cancer survivors. It suggests that physical activity may improve QOL in breast cancer survivors and can inform future research and interventions to improve cancer survivorship [21].

We conducted a literature review on physical activity and quality of life in breast cancer patients. This article should encourage health services and breast cancer survivors to continue physical activity suited to their conditions and evaluate the benefits.

2. Material and methods

2.1. Search strategy and inclusion criteria

A systematic search was conducted in PubMed, Web of Science, Scopus, and Google Scholar databases, covering 2017 to 2024. The search utilized title/abstract or Medical Subject Headings (MeSH terms), including “breast cancer”, “breast neoplasm”, “breast cancer survivors”, “exercise”, “physical activity”, “quality of life”, “depression”, and “anxiety”. We conducted a comprehensive evaluation and incorporated all literature written in English.

2.2. Study design

This review includes all interventional investigations, such as randomized clinical trials, clinical trials, and quasi-experimental studies.

2.3. Study selection

The search results were transferred into the Mendeley software, eliminating duplicate records. The texts of possibly relevant papers were examined to determine if they satisfied the inclusion criteria. This procedure

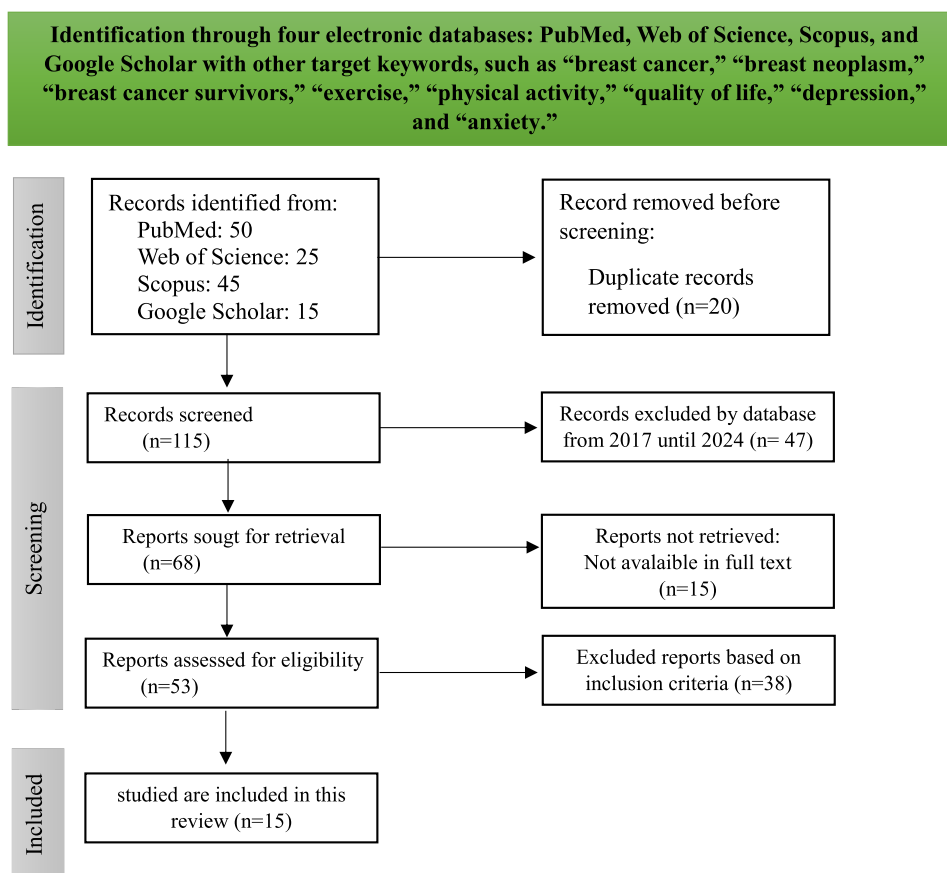


Fig. 1. Study selection process.

was executed with the involvement of two independent reviewers. All conflicts were settled through discourse. Figure 1 displays the procedure for selecting the study.

The results of this study support the benefits of physical activity for breast cancer survivors, including improved physical and emotional well-being, social support, and cognitive function. Research has shown that exercise can improve cancer survivors' quality of life by improving physical function, mental health, and social engagement. Physical activity, such as aerobics, strength training, and stretching exercises, improves breast cancer survivors' quality of life by improving cardiovascular health, strength, endurance, flexibility, social support, cognitive performance and disease outcomes (Fig. 2).

3. Result

See Table 1.

4. Discussion

In 2023, Mengying Sun et al. investigated how physical activity affects quality of life, anxiety, and depression in breast cancer survivors in China. There were 26 studies and 2105 participants. Physical activity helped depression, anxiety, and quality of life, but not statistically [18].

In South Korea, Woo-kyoung Shin et al. (2017) discovered that high-activity people had lower weariness and pain levels and more outstanding sexual function scores. Physical activity boosted physical function in stage breast cancer survivors but impaired fatigue and sexual function in stages II and III [22].

Another randomized controlled trial by Dagfinn Aune et al. (2022) examined how physical activity affects breast cancer patients' quality of life. Quality of life measurements FACT-G, EORTC QLQ-C30, and SF-36 showed consistent advantages. The study

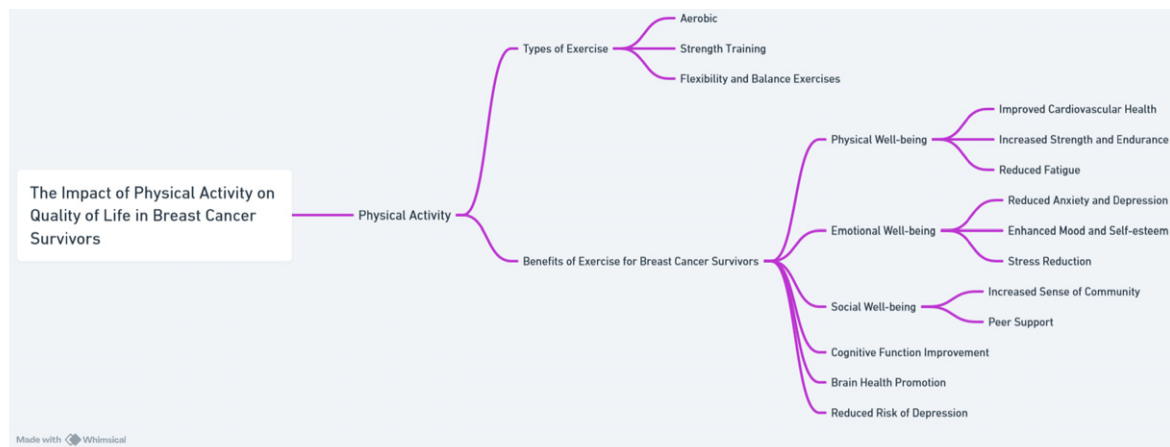


Fig. 2. The impact of Physical activity on breast cancer survivor.

reinforces prior findings that exercise improves quality of life and physical function slightly but significantly [23]. This suggests that physical activity programs can improve overall quality of life [24].

A study of postmenopausal breast cancer patients found that 45% took aromatase inhibitors to prevent recurrence and increase quality of life. The survey indicated that 50% fulfilled ACSM leisure-time physical activity and weekly walking recommendations, and 36.5% met strength training goals. According to this research, healthcare providers must recognize particular relationships between symptoms, side effects, and physical activity [25].

In 2020, Ji-Hye Park et al. found that frequent exercise helps cancer patients. It improves mobility, reduces fatigue, manages pain, and reduces dyspnea. The study emphasizes the dose-response link between physical activity and quality of life, underlining the relevance of exercise for cancer patients [26].

Maria Chiara Bò et al. (2023) found that self-managed physical activity therapy can greatly help adult breast cancer patients. It can boost self-care, oncology results, and patient empowerment. PA can improve health and condition management since healthcare providers can help patients control their health through physical activity [27].

In line with earlier studies, Pedro G.F. Ramos et al. (2024) conducted a comprehensive evaluation of home exercise programs (HBE) on breast cancer survivors' functional performance, physical activity, and adherence. Most of the 26 research involved organized or directed treatments. Most reported better functional performance, more exercise, and good adherence. HBE

therapy may improve functional performance and physical activity in breast cancer survivors, according to this review [12,13].

Siobhan M. Phillips et al. (2020) discovered that daily chemotherapy symptom changes can limit activities. Women aged more than 18 years with stage I to III breast cancer wore accelerometers and rated symptoms for 10 days. During chemotherapy, symptoms were significantly associated with moderate to vigorous physical activity (MVPA) and light physical activity (LPA). Previous anxiety was linked to LPA the following day. This study encourages more research on symptoms and activity and whether controlling for symptoms improves chemotherapy-related physical activity promotion programs [29].

Boing et al. (2018) discovered that breast cancer patients often had decreased quality of life due to exercise. Physical activity and quality of life questionnaires were given to 174 women. Results showed that most women, especially those getting treatment, did not meet the physical activity criterion. However, walking length increased functional capacity loss and treatment-related symptoms [30]. According to the study, walking is an effective type of physical activity for women with breast cancer [37].

In 2023, Tzu-Chieh Wang et al. found that combining aerobic exercise and strength training improved the quality of life of breast cancer survivors after 12 weeks, decreased the likelihood of quitting exercise, and may have helped doctors and patients make appropriate exercise decisions [31].

According to Renee Turzanski Fortner et al. (2023), physical activity improved breast cancer outcomes. Pre- and post-diagnosis activity changes and intensity

Table 1
Quality assessment of included studies

No	Author, Country	Study characteristics	Key findings	Quality of life aspects impacted	Methodology	Limitations	Reference
1	Mengying Sun, et al. China 2023	A total of 26 studies involving 2105 participants were searched between 1 January 2012 and 30 April 2022.	Physical activity increases quality of life, reduces anxiety, and alleviates depression in breast cancer survivors. However, depression was not significantly affected.	Physical activity considerably lowered anxiety but not depression.	Systematic Review and Meta-analysis	The meta-analysis found no significant effect of physical activity on depression in breast cancer survivors, probably due to lack of desire, low self-worth, poor body image, and lack of support.	[18]
2	Woo-kyoung Shin, et al. South Korean 2017	From September 2012 to April 2015, the three hospitals recruited 231 women aged 21 to 78 who had stage I to III breast cancer and had undergone at least 6 months of surgery.	Physical activity decreases fatigue and pain in cancer survivors, enhances sexual function, and helps all stages, especially stages II and III, with stronger effects in later stages.	Physical activity significantly improved every component of breast cancer survivors' quality of life (p-value <0.05). Exercise reduces fatigue, discomfort, and sexual dysfunction in breast cancer survivors, improving their quality of life.	A cross-sectional study	This study's limitations include the absence of pre-diagnostic data, restricted sample size, and no HRQOL evaluation after physical activity assessment.	[22]
3	Maria-Eleni Spei, et al. Italy 2019	Post-diagnosis physical activity and breast cancer prognosis	The meta-analysis supports post-diagnostic recreational physical activity's favorable effects on total mortality, breast cancer-specific mortality, and possible recurrence.	High physical activity post-breast cancer diagnosis reduces all-cause and breast cancer mortality, possibly enhancing cardiovascular mortality and breast cancer survival, according to a meta-analysis of ten trials.	A systematic review and meta-analysis	Small sample size, poor meta-regression approaches, and lack of physical activity data prevent dose-response meta-analysis.	[23]
4	Dagfinn Aune, et al. UK 2022	Seventy-nine randomized controlled trials (14 554 breast cancer patients) were included.	Physical activity greatly improves health-related quality of life. However, physical functioning and mental/emotional health were less affected.	A validated assessment showed breast cancer survivors' HRQoL improved after physical activity.	A systematic review and meta-analysis	Physical activity improves breast cancer survivors' quality of life, but kinds vary. Follow guidelines and study the association between activity dosage and quality of life.	[24]

Table 1 (Continued).

No	Author, Country	Study characteristics	Key findings	Quality of life aspects impacted	Methodology	Limitations	Reference
5	K.E. Dibble, et al. USA 2020	Postmenopausal women with breast cancer (n = 170), ages 50–95 years (M= 68.7), diagnosed with stage 1–3 disease, 45% on AIs, were recruited.	Strength training involvement was lower, although 50% met prescribed physical activity levels. Wellness is enhanced with Aromatase Inhibitors (AIs).	Aromatase inhibitors (AIs) may promote emotional, physical, and social well-being. However, adverse effects may occur, therefore, healthcare providers must understand how symptoms and physical activity relate.	Self-report and Automated data extraction from medical record	More research is needed to discover how physical activity can reduce negative effects.	[25]
6	Ji-Hye Park, et al. South Korean 2020	A total of 224 cancer survivors (151 breast and 73 colorectal cancers) who completed treatments were recruited.	The study indicated that moderate to vigorous physical activity (PA) enhances the quality of life for Korean breast and colorectal cancer survivors.	Exercise improves physical function, reduces fatigue, manages pain, and enhances lung function for cancer survivors, with higher amounts leading to better quality of life outcomes.	This cross-sectional investigation was conducted at Seoul's Shinchon Severance Hospital Cancer Clinic.	Cross-sectional studies and accelerometer-based measurements may restrict causal findings, but they encourage future research into moderate to strenuous exercise's effects on Korean cancer survivors' quality of life.	[26]
7	Maria Chiara Bò, et al. Italy 2023	This review included adult breast cancer survivors who have begun treatment and are at any stage of long-term recovery.	Self-managed physical activity (PA) programs can improve oncological outcomes, reduce medication side effects, and assist patients in incorporating self-care like exercise into daily routines. Patients get long-term health management skills from these programs.	Self-managed physical activity (PA) programs for breast cancer patients may decrease treatment adverse effects, enhance mental health, and empower individuals to manage their health.	A scoping review	The main limitation of this review is the risk of not including all research on self-care due to new cancer rehabilitation. This review only covers primary PA interventions, not psychological or nutritional ones.	[27]
8	Pedro G.F. Ramos, et al. Portugal 2024	The studies included were randomized controlled trials (RCT) published in English until January 15th, 2024, involving stage 0-III breast cancer diagnosis.	Home exercise (HBE) programs have been found to enhance functional performance and physical activity in breast cancer survivors, according to a review of 26 structured studies.	HBE programs improve breast cancer survivors' quality of life by boosting physical activity and function. Better strength, balance, flexibility, and well-being can result.	A systematic review	The review's focus on English-speaking countries limits extrapolation to non-English-speaking people and fails to capture cultural variances in home-based fitness program interventions, with 79% of studies having poor methodological quality.	[28]

Table 1 (Continued).

No	Author, Country	Study characteristics	Key findings	Quality of life aspects impacted	Methodology	Limitations	Reference
9	Siobhan M. Phillips, et al. USA 2020	The study included 18+ women with stage I to III breast cancer, scheduled for chemotherapy, able to complete baseline data collection, operable tumor, no history of other primary cancers, smartphone, internet access, and English reading and writing skills.	During chemotherapy in breast cancer patients, fatigue, pain, difficulty walking, decreased physical function of activities of daily living (ADLs), and cognitive function worsen, reducing moderate to vigorous physical activity (MVPA) and light physical activity.	Patient quality of life, emotional well-being, social interactions, and everyday functioning might be affected by decreased activity and increased symptoms.	This prospective, longitudinal study uses Ecological momentary assessment (EMA) methodology.	Chemotherapy symptoms might lower physical activity daily. Deteriorating anxiety symptoms directly affect patient engagement.	[29]
10	Leonessa Boing, et al. Brazil 2018	Sample of 174 women (57.0 ± 9.5 years) during or after clinical treatment for breast cancer at the Oncology Research Center (CEPON) in the city of Florianopolis, Santa Catarina, Brazil.	Breast cancer patients generally fail to meet physical activity guidelines, especially during treatment. They walked longer, functioned better, and had fewer problems following treatment.	Post-treatment women walked more, reducing symptomatology and low QOL by 19% and 26%, highlighting the necessity for health professionals' support.	An exploratory, descriptive cross-sectional study	Since clinical record charts were unavailable, the cross-sectional investigation used a subjective, retrospective physical activity questionnaire and self-reported data without cause-and-effect relationships.	[30]
11	Tzu-Chieh Wang, et al. Taiwan 2023	Patients who have finished surgery, chemotherapy, and radiation for breast cancer	Aerobic and weight training improved breast cancer survivors' quality of life, the highest after 12 weeks.	Combining aerobic and strength training is the most effective method to improve breast cancer survivors' quality of life, reduce exercise drop-out rates, and improve exercise planning.	A Network Meta-Analysis of Randomized Controlled Trials	This 12-week study examined how exercise duration affects quality of life and found no statistical differences or instability.	[31]
12	Renee Turzanski Fortner, et al. USA 2023	This study evaluated physical activity and survival after breast cancer diagnosis in the Nurses' Health Study and Nurses' Health Study II (n=9308 women, n=1973 deaths).	A 1-3 h weekly walking increase reduces breast cancer-specific and all-cause mortality after diagnosis.	Following diagnosis, walking and strength exercises can improve breast cancer survivors' health and quality of life, improving their well-being.	A Prospective Observational Study	Racial and cultural differences may restrict this study's generalizability, requiring a more diverse sample.	[32]

Table 1 (Continued).

No	Author, Country	Study characteristics	Key findings	Quality of life aspects impacted	Methodology	Limitations	Reference
13	Rebecca D. Kehm, et al. USA 2021	Recreational physical activity significantly reduces all-cause mortality and second breast cancer in women diagnosed between 1993 and 2011.	RPA reduced all-cause mortality by 16.1%, especially in women with BRCA1 and BRCA2 pathogenic variants (BRCA1/2 PVs), which fell by 47.5%.	Physical activity can improve quality of life, long-term survival, and health management after breast cancer diagnosis, especially for women at higher genetic risk.	The Prospective Family Study Cohort	The prospective study design makes self-reported data nondifferential, which could misclassify exposure.	[33]
14	Susan Aguinaga, et al. US 2018	A study of 387 breast cancer patients aged 21 and older completed primary chemotherapy and radiation therapy on an iPad, excluding iPhone users.	After breast cancer, low physical activity results in fatigue, depression, and a lower quality of life, while high exercise helps survivors manage their mental health.	Physical activity reduces weariness and sadness, builds strength, stamina, and self-care, and increases social contact and connections.	Cross-sectional studies are particularly beneficial for analyzing correlations among variables.	The study on breast cancer survivors' physical exercise and psychological well-being may be biased due to self-reported data, cross-sectional design, insufficient control, and small sample size.	[34]
15	Ana Joaquim, et al. Portugal 2022	The final analysis included 12 of 101 studies. The study includes hormone therapy and anti-HER2 medicine-treated adult breast cancer survivors who had completed curative treatment for at least one month.	Longer physical activity interventions increased cardiorespiratory fitness, muscle strength, and pain perception in 83.3% of studies, notably among breast cancer survivors.	Exercise enhanced health-related quality of life in 83.3% of eligible studies, showing its value in breast cancer survivors' well-being.	Systematic reviews and meta-analyses	Various literature, low evidence quality, and lack of long-term intervention effects imply that future research should reduce bias and enhance intervention descriptions.	[35]

and type assessments were compared in this study. Increased post-diagnosis exercise was inversely connected to breast cancer-specific and all-cause mortality. Walking and strength training reduces mortality. It increased weekly walking by 1–3 h, which reduced all-cause mortality. These findings encourage breast cancer patients to be more active [32].

Rebecca D. Kehm et al.'s 2021 study found that recreational physical activity (RPA) lowers all-cause mortality and second breast cancer in women diagnosed with breast cancer between 1993 and 2011. The study included 4610 women after controlling for age, demography, and lifestyle. With a relative extra risk of 0.87, RPA and BRCA1/2 pathogenic mutations interacted. Maintaining or enhancing RPA in BC women, especially those with higher familial risk, could improve survival rates [33].

In 2018, Susan Aguiñaga et al. studied the impact of physical activity on psychological well-being in breast cancer survivors. The study comprised 387 patients who self-reported physical activity before and after diagnosis. High-active maintainers reported the highest quality of life and lowest weariness and depression. The study suggests survivors' psychological well-being may depend on high physical exercise [34].

Ana Joaquim et al. (2022) examined how exercise affects breast cancer survivors' quality of life, cardiorespiratory fitness, muscle strength, and body composition. In 83.3% of 101 qualified trials, physical activity improved health-related quality of life. It reduces weight and waist circumference and improves cardiorespiratory fitness. In order to improve health outcomes after breast cancer treatment, this study suggests that health practitioners advocate physical activity interventions [35].

Physical activity improves cancer patients' quality of life and mental health. Physical function, treatment side effects, sleep, anxiety, sadness, mood, self-esteem, stress, and social involvement improve. Group fitness programs help cancer patients stay healthy during stressful times. People living with Cancer benefit from exercise [38–42].

5. Conclusion

Physical activity improves the quality of life, mental health, physical function, risk of death, empowerment, and exercise adherence among breast cancer survivors. Studies show that more activity has more benefits. Together, cardio and strength training may be more effective. Walking is a great exercise for breast cancer

survivors and is easy to do. Healthcare providers help patients see the benefits of exercise and develop safe, effective workouts that meet their needs and restrictions.

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Ethics committee

Not applicable.

Conflict of interest

Each author declares that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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The data presented in this study are available on request from the corresponding author.

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Authors contribution

NQA, MA, and PP study design; NQA, PP, and ANU databases search and articles selection; All authors participate in the debate and consensus on the articles to be included. NQA, ANU, and DIA manuscript writing. AA, ANU, FI, and DIA proof-reading of the manuscript.

References

- [1] Keane D, Phillips G, Mitchell N, Connolly RM, Hegarty J, Improving quality of life and symptom experience in patients with metastatic breast cancer: A systematic review of supportive care interventions, *Psycho-Oncology*, 32(8): 1192–1207, 2023. doi:10.1002/pon.6183.
- [2] Kida K, Olver I, Yennu S, Tripathy D, Ueno NT, Optimal supportive care for patients with metastatic breast cancer according

- to their disease progression phase, *JCO Oncol Pract*, 17(4): 177–183, 2021. doi:10.1200/OP.20.00622.
- [3] Riis CL, Bechmann T, Jensen PT, Coulter A, Steffensen KD, Are patient-reported outcomes useful in post-treatment follow-up care for women with early breast cancer? A scoping review, *Patient Relat Outcome Meas*, 10: 117–127, 2019. doi:10.2147/PROM.S195296.
- [4] Paravathaneni M et al., 15 years of patient-reported outcomes in clinical trials leading to GU cancer drug approvals: A systematic review on the quality of data reporting and analysis, *eClinicalMedicine*, 68: 102413, 2024. doi:10.1016/j.eclinm.2023.102413.
- [5] IJsbrandy C, Ottevanger PB, Tsekou Diogeni M, Gerritsen WR, van Harten WH, Hermens RMPG et al., Review: Effectiveness of implementation strategies to increase physical activity uptake during and after cancer treatment, *Crit Rev Oncol Hematol*, 122: 157–163, 2018. doi:10.1016/j.critrevonc.2017.09.005.
- [6] Depenbusch J, Wiskemann J, Haussmann A, Tsiouris A, Schmidt L, Ungar N et al., Impact and determinants of structural barriers on physical activity in people with cancer, *Int J Behav Med*, 29(3): 308–320, 2021. doi:10.1007/s12529-021-10014-0.
- [7] World Health Organization (WHO) et al., Oncology TL. *The Global Breast Cancer Initiative (GBCI)*, 2045(21): 1–2, 2021. <https://www.who.int/publications/m/item/the-global-breast-cancer-initiative-gbci>.
- [8] Organization WH, the-global-breast-cancer-initiative-flyer-june-2022.pdf, 2022. <https://www.who.int/initiatives/global-breast-cancer-initiative>.
- [9] Organization WH, Global Breast Cancer Initiative Implementation Framework Assessing, strengthening and scaling up services for the early detection and management of breast cancer, 2023. <https://www.who.int/publications/i/item/9789240067134>.
- [10] Ong SK et al., Feasibility of monitoring Global Breast Cancer Initiative Framework key performance indicators in 21 Asian National Cancer Centers Alliance member countries, *eClinicalMedicine*, 67: 102365, 2024. doi:10.1016/j.eclinm.2023.102365.
- [11] Bea JW, de Heer H 'Dirk', Kinslow B, Valdez L, Yazzie E, Curley P et al., Perceptions of cancer causes, prevention, and treatment among Navajo cancer survivors, *J Cancer Educ*, 35(3): 493–500, 2019. doi:10.1007/s13187-019-01487-5.
- [12] Park J, Rodriguez JL, O'Brien KM, Nichols HB, Hodgson ME, Weinberg CR et al., Health related quality of life outcomes among breast cancer survivors, *Cancer*, 127(7): 1114–1125, 2020. doi:10.1002/ncr.33348.
- [13] Liska TM, Kolen AM, The role of physical activity in cancer survivors' quality of life, *Health Qual Life Outcomes*, 18(1) 2020. doi:10.1186/s12955-020-01448-3.
- [14] Vehmanen L et al., Associations between physical exercise, quality of life, psychological symptoms and treatment side effects in early breast cancer, *Breast J*, 2022: 1–8, 2022. doi:10.1155/2022/9921575.
- [15] Wonders KY, Schmitz K, Wise R, Hale R et al., Cost-savings analysis of an individualized exercise oncology program in early-stage breast cancer survivors: A randomized clinical control trial, *JCO Oncol Pract*, 18(7): e1170–e1180, 2022. doi:10.1200/OP.21.00690.
- [16] Czenczek-Lewandowska E, Szeliga E, Leszczak J et al., The effect of aquatic and land exercise on the mental well-being of women following breast cancer surgery-comparative study, *Breast Cancer Res Treat*, 202(3): 585–593, 2023. doi:10.1007/s10549-023-07088-7.
- [17] Gentile A et al., Choose the healthy way! Physical activity as a tool to improve mental health in young cancer survivors, *Acta Oncol*, 62(12): 1589–1591, 2023. doi:10.1080/0284186X.2023.2270154.
- [18] Sun M, Liu C, Lu Y, Zhu F, Li H, Lu Q, Effects of physical activity on quality of life, anxiety and depression in breast cancer survivors: A systematic review and meta-analysis, *Asian Nurs Res*, 17(5): 276–285, 2023. doi:10.1016/j.anr.2023.11.001.
- [19] Zanghì M, Petrigna L, Maugeri G, D'Agata V, Musumeci G et al., The practice of physical activity on psychological, mental, physical, and social wellbeing for breast-cancer survivors: An umbrella review, *Int J Environ Res Public Health*, 19(16): 10391, 2022. doi:10.3390/ijerph191610391.
- [20] Salas M, Mordin M, Castro C, Islam Z, Tu N, Hackshaw MD et al., Health-related quality of life in women with breast cancer: A review of measures, *BMC Cancer*, 22(1) 2022. doi:10.1186/s12885-021-09157-w.
- [21] Han X, Robinson LA, Jensen RE, Smith TG, Yabroff KR, Factors associated with health-related quality of life among cancer survivors in the United States, *JNCI Cancer Spectr*, 5(1) 2021. doi:10.1093/jncics/pkaa123.
- [22] Shin W-k, Song S, Jung S-Y, Lee E, Kim Z, Moon H-G, The association between physical activity and health-related quality of life among breast cancer survivors, *Health Qual Life Outcomes*, 15(1) 2017. doi:10.1186/s12955-017-0706-9.
- [23] Spei M-E, Samoli E, Bravi F, La Vecchia C, Bamia C, Benetou V et al., Physical activity in breast cancer survivors: A systematic review and meta-analysis on overall and breast cancer survival, *Breast*, 44: 144–152, 2019. doi:10.1016/j.breast.2019.02.001.
- [24] Aune D et al., Physical activity and health-related quality of life in women with breast cancer: A meta-analysis, *JNCI Cancer Spectr*, 6(6) 2022. doi:10.1093/jncics/pkac072.
- [25] Dibble KE, Bellizzi KM, Taxel P, Pescatello LS, Siembida EJ, Schifano ED et al., Physical activity and health-related quality of life among postmenopausal women with breast cancer treated with aromatase inhibitors, *Support Care Cancer*, 29(5): 2385–2394, 2020. doi:10.1007/s00520-020-05741-1.
- [26] Park J-H, Lee DH, Kim SI, Kim NK, Jeon JY et al., Moderate to vigorous physical activity participation associated with better quality of life among breast and colorectal cancer survivors in Korea, *BMC Cancer*, 20(1) 2020. doi:10.1186/s12885-020-06819-z.
- [27] Bò MC, Merlo A, Ligabue MB, Bassi MC, Lusuardi M, Campanini I et al., Self-managed physical activity in breast cancer survivors: A scoping review, *PLoS One*, 18(4): e0284807, 2023. doi:10.1371/journal.pone.0284807.
- [28] Ramos PGF, Júdice PB, Nobre I, Carraça EV et al., Home-based exercise interventions' impact on breast cancer survivors' functional performance: A systematic review, *J Cancer Surviv*, 2024. doi:10.1007/s11764-024-01545-y.
- [29] Phillips SM et al., Daily physical activity and symptom reporting in breast cancer patients undergoing chemotherapy: An intensive longitudinal examination, *Cancer Epidemiol Biomarkers Prev*, 29(12): 2608–2616, 2020. doi:10.1158/1055-9965.EPI-20-0659.
- [30] Boing L, Pereira GS, Vieira MdCS, Seemann T, Cardoso AA, Sperandio FF et al., Physical activity and quality of life in women with breast cancer — A cross-sectional study, *Revista Brasileira de Medicina do Esporte*, 24(5): 377–381, 2018. doi:10.1590/1517-869220182405182631.
- [31] Wang T-C, Chen P-L, Liao W-C, Tsai I-C et al., Differential impact of exercises on quality-of-life improvement in

- breast cancer survivors: A network meta-analysis of randomized controlled trials, *Cancers*, 15(13): 3380, 2023. doi:10.3390/cancers15133380.
- [32] Fortner RT, Brantley KD, Tworoger SS, Tamimi RM, Rosner B, Farvid MS et al., Physical activity and breast cancer survival: Results from the Nurses' Health Studies, *JNCI Cancer Spectr*, 7(1) 2022. doi:10.1093/jncics/pkac085.
- [33] Kehm RD et al., Recreational physical activity and outcomes after breast cancer in women at high familial risk, *JNCI Cancer Spectr*, 5(6) 2021. doi:10.1093/jncics/pkab090.
- [34] Aguiñaga S, Ehlers DK, Cosman J, Severson J, Kramer AF, McAuley E et al., Effects of physical activity on psychological well being outcomes in breast cancer survivors from prediagnosis to posttreatment survivorship, *Psychooncology*, 27(8): 1987–1994, 2018. doi:10.1002/pon.4755.
- [35] Joaquim A, Leão I, Antunes P, Capela A, Viamonte S, Alves AJ et al., Impact of physical exercise programs in breast cancer survivors on health-related quality of life, physical fitness, and body composition: Evidence from systematic reviews and meta-analyses, *Front Oncol*, 12:2022. doi:10.3389/fonc.2022.955505.
- [36] Islam T, Lin LY, Danaee M, Taib NA et al., Physical activity and quality of life in Malaysian breast cancer survivors: A longitudinal study, *JCO Global Oncol*, 8(Supplement_1): 31, 2022. doi:10.1200/GO.22.37000.
- [37] Misiąg W, Piszczyk A, Szymańska-Chabowska A, Chabowski M et al., Physical activity and cancer care—A review, *Cancers*, 14(17): 4154, 2022. doi:10.3390/cancers14174154.
- [38] Patria B et al., Modeling the effects of physical activity, education, health, and subjective wealth on happiness based on Indonesian national survey data, *BMC Public Health*, 22(1) 2022. doi:10.1186/s12889-022-13371-x.
- [39] Noetel M et al., Effect of exercise for depression: Systematic review and network meta-analysis of randomised controlled trials, *BMJ*, 384(8471): e075847, 2024. doi:10.1136/bmj-2023-075847.
- [40] Zhang Z, Chen W et al., A systematic review of the relationship between physical activity and happiness, *J Happiness Stud*, 20(4): 1305–1322, 2018. doi:10.1007/s10902-018-9976-0.
- [41] Mahindru A, Patil P, Agrawal V et al., Role of physical activity on mental health and well-being: A review, *Cureus*, 2023. doi:10.7759/cureus.33475.
- [42] Vallance JK, Depression, happiness, and satisfaction with life in women newly diagnosed with breast cancer: Associations with device measured physical activity and sedentary time, *Psychooncology*, 32(8): 1268–1278, 2023. doi:10.1002/pon.6180.