The Effects of a Pilates Exercise Program on Pain, Functional Capacity, and Quality of Life in Breast Cancer Survivors One Year Postsurgery

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OBJECTIVES: To evaluate the effects of Pilates exercises on functional capacity, pain, and quality of life in breast cancer survivors one year postsurgery.

SAMPLE & SETTING: 44 breast cancer survivors who participated in a 24-session Pilates exercise program at a physiotherapy clinic in Brazil.

METHODS & VARIABLES: This prospective longitudinal study evaluated breast cancer survivors who performed Pilates exercises for 60 minutes twice weekly. Functional capacity was analyzed using the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH) and the Shoulder Pain and Disability Index (SPADI). Pain and quality of life were also analyzed. Scores were measured on admission, after 12 sessions, and after 24 sessions.

RESULTS: Median DASH and SPADI scores improved by 61% after 24 Pilates exercise sessions. The average number of breast cancer survivors who performed complex tasks without difficulty after 12 sessions and 24 sessions increased considerably. Pain scores significantly decreased, and quality of life significantly improved after all sessions.

IMPLICATIONS FOR NURSING: Incorporating a Pilates exercise program can decrease pain and improve functional status and quality of life among breast cancer survivors at least one year postsurgery.

KEYWORDS Pilates; breast cancer survivors; pain; functional capacity; quality of life; exercise

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Breast cancer treatment aims to increase disease-free survival for women following diagnosis. It is estimated that 99% of women with a local diagnosis and 85% of women with a locoregional diagnosis are alive five years after diagnosis, regardless of race or age (Howlader et al., 2021). About 25%–60% of women with breast cancer report persistent postoperative pain and limited range of motion of the shoulder and the homolateral upper limb following surgery (Khan et al., 2020). These conditions can lead to muscle hypotrophy and reduce the strength and function of the affected limb, functional capacity, and quality of life. However, pain is not limited to the early postoperative period, and 52% of women reported experiencing symptoms more than twice a week or daily 36 months after surgery. The incidence of and discomfort experienced from late symptoms varies among patients (Pillai et al., 2019). According to a study by Iovino et al. (2019), 30% of patients developed postoperative shoulder–arm morbidity following breast cancer surgery. The most common long-term shoulder–arm problems included pain, numbness, impairment of mobility and strength, lymphedema, and frozen shoulder (Iovino et al., 2019). Similarly, a study by Hauerslev et al. (2020) found that the majority of participants complained of one or more subjective symptoms related to shoulder and arm morbidity more than 11 years after undergoing surgery for breast cancer. Forty-nine percent of participants had one or more functional impairments, and 64% had one or more subjective locoregional symptoms, such as pain, swelling of the arm, and decreased shoulder mobility (Hauerslev et al., 2020).

In a study by Martins da Silva and Rezende (2014), physical functional disabilities were present in the

late postoperative period (after one year) among breast cancer survivors, and limited range of motion in the shoulder negatively influenced survivors' functional capacity and quality of life. Limited range of motion was reported in the ipsilateral shoulder in 82 women who were in the postoperative period for at least one year or more. The mean shoulder flexion range of motion was 155.44° (SD = 28.31), mean external shoulder rotation was 58.44° (SD = 29.17), and mean abduction was 149.05° (SD = 29.51). These limitations had a negative impact on survivors' functional capacity and overall quality of life. Research on late rehabilitation (at least one year postsurgery) for patients with breast cancer is needed to improve quality of life and because most studies focus only on early rehabilitation (Martins da Silva & Rezende, 2014).

Because of continuously improving treatment methods aimed at eliminating cancer, breast cancer survivors comprise a growing population of individuals living with challenges that affect their health-related quality of life. The long-term effects of breast cancer treatment are well known. To facilitate a return to normal life for patients in this population, participation in a rehabilitation exercise program is advised (Stalsberg et al., 2019). Several rehabilitation programs have been developed to improve functional capacity and quality of life for breast cancer survivors in the postoperative period. Although the literature supports the implementation of exercise for breast cancer survivors and its benefits, the methods used in exercise protocols varied greatly (Líška & Rutkowski, 2021). More recent approaches to exercise, such as Pilates, have also been studied. Pilates focuses on muscle strength and flexibility through exercises that are based on centering the body, control, precision, breathing, and flow. Although the number of studies that have evaluated the use of Pilates exercises in patients with breast cancer is limited, their effects in this patient population have been reported to be positive (Alpozgen et al., 2017; Atilgan et al., 2017; Eyigor et al., 2010).

In a study by Stan et al. (2012) of female patients with breast cancer on a rehabilitation unit, Pilates exercises that were performed in the early postoperative period three times per week for a period of eight weeks were effective and safe. Pilates improved shoulder abduction and internal rotation on the affected side, neck rotation toward the unaffected side, and neck flexion. Improvements in quality of life, mood, and body image were also reported (Stan et al., 2012). In the late postoperative period, the use of Pilates exercises with breast cancer survivors receiving hormone therapy improved postural alignment and balance (de Bem Fretta et al., 2021) and demonstrated a significant difference in pain reduction (de Paula Barbosa et al., 2021).

The current study is the first to investigate the effects of Pilates exercise during the late postoperative period (at least one year postsurgery) among breast cancer survivors with functional complications. Despite the importance of breast cancer shoulder mobility and although the amount of research that has been focused on late effects has been steadily increasing during the past few years, late symptoms may be neglected and underestimated. Because of the potential benefits of Pilates for rehabilitation among breast cancer survivors and the need to minimize the adverse effects of surgery and improve patients' well-being, this study aimed to determine the effects of a Pilates exercise program on functional capacity, pain, and quality of life among breast cancer survivors at least one year after surgery. Participants were evaluated after 12 sessions and 24 sessions of Pilates exercises with the aim of verifying substantial results.

Methods

Design and Participants

Sixty-five eligible patients were identified by screening the outpatient schedules in the physiotherapy clinic at the University Centre of Teaching Faculties (UNIFAE) in São João da Boa Vista, Brazil, for one year in 2019. This prospective quantitative longitudinal study followed 47 women with breast cancer in the late postoperative period (at least one year after surgery). Patients were eligible for the study if they were one year or more post–unilateral breast cancer surgery. Patients with metastasis, those who were unable to perform the Pilates exercises, and those who were absent for more than 25% of the total number of days scheduled for Pilates were excluded. No participants performed others exercises while participating in the Pilates exercise program. Three participants dropped out of the study because of public transportation difficulties. Forty-four participants were included in the final sample.

All participants were informed about the study objectives and provided written informed consent. Data were stored and analyzed statistically. The study conformed to human research guidelines and was approved by the research ethics committee (No. 2.702.640) at the study institution. All equipment used was funded by the Brazilian National Council for Scientific and Technological Development (Process No. 428926/2016-9).

Variables and Instruments

Sociodemographic and clinical data, including age, body mass index, level of education, occupation, type of surgery, and type of treatment, were collected. Validated and reliable questionnaires were used to measure pain (Hayes et al., 2012; Lokapavani et al., 2014; Nguyen et al., 2015), functional capacity (European Organisation for Research and Treatment of Cancer [EORTC], n.d.), and quality of life (Şener et al., 2017). Pain was assessed using the visual analog scale (VAS), which ranks pain on a scale ranging from 0 (no pain) to 10 (worst pain) (Lokapavani et al., 2014), and the Shoulder Pain and Disability Index (SPADI), which measures pain and disability because of shoulder dysfunction using 13 items and a scale ranging from 0 (no pain) to 10 (worst pain) (Nguyen et al., 2015). Functional capacity was quantified using the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH), which consists of 30 questions that examine the functional capacity of the shoulders, elbows, wrists, and hands. Each item is scored on a five-point Likert-type scale, and a cumulative DASH score is calculated on a scale ranging from 0 (no dysfunction) to 100 (severe dysfunction) (EORTC, n.d.). Quality of life was measured using the Functional Assessment of Cancer Therapy–Breast (FACT-B), which contains 37 questions that evaluate overall quality of life (27 items) and breast cancer complications (10 items). Each item is scored on a five-point Likert-type scale ranging from 0 (none) to 4 (very much) (Nguyen et al., 2015). Quality of life was also estimated using the EORTC Quality-of-Life Questionnaire–Core 30 (EORTC QLQ-C30) and the EORTC QLQ–Breast Cancer Module (EORTC QLQ-BR23) (Şener et al., 2017), which are multidimensional and self-administered instruments that assess cancer symptoms, treatment side effects, psychosocial aspects, physical functioning, and overall sexual health. The EORTC QLQ-C30 measures overall health and quality of life, whereas the EORTC QLQ-BR 23 exclusively rates the health status of patients with breast cancer. Lower scores on the questionnaires indicate a higher level of quality of life or functional capacity.

Procedures

Twenty-four Pilates exercise sessions were performed twice per week for 60 minutes. Outcome measures were evaluated on admission, at 6 weeks (after 12 sessions of Pilates exercises), and at 12 weeks (after 24 sessions of Pilates exercises). The Pilates equipment used included the Cadillac, Step Chair, Reformer, and Barrel. Participants were instructed to keep the pelvis neutral; initiate a movement by inhaling through the nose and expanding the rib cage; and finish the movement by exhaling through the mouth, contracting the abdomen, and activating the transverse muscles (Alpozgen et al., 2017; Cancelliero-Gaiad et al., 2014; Eliks et al., 2019). Using the Pilates method, participants in the intervention group performed exercises targeting the upper and lower limbs, trunk, and abdomen. Participants performed the Pilates exercises individually at the Pilates studio in the physiotherapy clinic at UNIFAE and were supervised by an experienced physiotherapist following an exercise protocol.

Statistical Analysis

Data were transferred to Microsoft Excel spreadsheets and analyzed using IBM SPSS Statistics, version 22.0. Sociodemographic data were expressed as means, standard deviations, and minimum and maximum values. Questionnaire scores were presented as medians. Internal consistency was analyzed using Cronbach's alpha coefficient, and values greater than or equal to 0.7 were considered satisfactory (de Bem Fretta et al., 2021). The three evaluations were compared using Friedman test, and the effect size was evaluated using Cohen's definitions (Cohen, 1988). P values of less than 0.05 were considered statistically significant.

Results

Data on sociodemographic characteristics, type of surgery, and treatments are presented in Table 1. The average age of participants was 57.77 years (SD = 12.31), and the average time elapsed since surgery was 7.2 years (SD = 4.92). The "other" category for occupation included teachers, salespeople, publicists, or maids.

The results of the study showed that Pilates exercises significantly decreased pain and improved functional capacity and quality of life (see Table 2). There was a significant decrease in pain scores on the VAS and SPADI at all three time points. Based on SPADI and VAS scores, the effect size was moderate after 24 sessions.

In addition, there was a significant improvement in shoulder function (measured using the SPADI) and functional capacity (measured using the DASH) following the Pilates exercise program. The effect size was strong based on participants' scores on the SPADI and moderate based on DASH scores.

On the DASH questionnaire, the activities considered most difficult or unachievable on admission

TABLE 1. Sample Characteristics (N = 44)

Characteristic	n
Age (years)	
35–39	3
40–44	5
45–49	5
50–54	3
55–59	9
60 or older	19
Body mass index (kg/m^2)	
Underweight	–
Normal weight	8
Overweight	18
Obese	18
Education level	
Illiterate	–
Did not complete elementary school	12
Completed elementary school	2
Did not complete high school	2
Completed high school	7
Did not complete college	4
Completed college or higher	17
Occupation	
Retired	18
Housework	8
Other[a]	18
Surgery	
Unilateral modified radical mastectomy	25
Lumpectomy and/or quadrantectomy	19
Treatment	
Chemotherapy and RT	17
Chemotherapy, RT, and hormone therapy	14
RT and hormone therapy	9
Hormone therapy	4

[a] Included teachers, salespeople, publicists, and maids
RT—radiation therapy

included placing objects on a shelf above the head, performing strenuous household chores (e.g., washing walls and the floor), carrying heavy objects (more than 5 kg), changing a light bulb, and practicing recreational activities that involved moving the arms freely, such as fishing and playing badminton. There was a significant increase in the average number of women who performed these tasks without difficulty after 12 sessions of Pilates exercises ($p = 0.015$) and after 24 sessions of Pilates exercises ($p = 0.002$) as compared to admission. The activities that were considered easier to perform included writing, turning keys, and cooking, and the tasks performed with moderate difficulty included strenuous household chores (e.g., washing the floor), activities that required strength or involved the arms (e.g., volleyball), washing the back, and cutting food with a knife.

There was a significant improvement in quality-of-life scores at all three time points. The effect size was moderate for all quality-of-life questionnaires at admission, after 12 sessions, and after 24 sessions, except for the EORTC QLQ-C30 between admission and 24 sessions, in which the effect size was strong.

The number of participants whose scores on items 1 ("Do you have difficulties carrying a heavy shopping bag or suitcase?"), 2 ("Do you have difficulties taking a long walk?"), 9 ("Have you experienced pain in the past few days?"), and 23 ("Do you feel irritated easily?") improved by the end of the Pilates exercise program, with scores increasing by 20% ($p = 0.005$). Internal consistency was high for the DASH, EORTC QLQ-C30 and EORTC QLQ-BR23, and SPADI (Cronbach's alpha = 0.92, 0.86, and 0.89, respectively) and satisfactory for the FACT-B (Cronbach's alpha = 0.7).

Discussion

The current study assessed the effects of a Pilates exercise program as a late rehabilitation strategy for women following breast cancer surgery. Pilates exercises significantly decreased pain and improved participants' functional capacity and quality of life. Based on the results, pain strongly affected participants' overall quality of life, but performing Pilates exercises twice per week (24 total sessions) reduced participants' postoperative pain. These results align with those in a study by Şener et al. (2017), in which an eight-week Pilates exercise program (three hours per week) following breast cancer surgery significantly improved the pain scores among 30 women ($p < 0.01$). Keays et al. (2008) also demonstrated that performing Pilates exercises after surgery for breast cancer decreased pain in four women. The current study is the first to assess pain after surgery for breast cancer using the VAS and SPADI.

In a study of women with breast cancer, Panchik et al. (2019) demonstrated that Pilates exercises improved quality of life, muscle strength, body mass index, and mental health, as well as reduced pain and lymphedema. The current study also found that the Pilates exercise program was clinically effective in reducing pain and improving functional capacity and quality of life, which is further supported by the

results of the study by Stan et al. (2012), wherein a 12-week Pilates exercise program following breast cancer surgery improved survivors' quality of life. Lastly, the results of the current study showed that median DASH and SPADI scores improved by about 61% during the 24-session Pilates exercise program, which corroborates the study findings of Eyigor et al. (2010), who found that functional capacity scores improved by 8% after implementation of a Pilates exercise program.

In the United States, 22% of breast cancer survivors who are diagnosed today can expect to be alive within the next five years (Howlader et al., 2021). Therefore, it is important for these individuals to understand how to deal with late effects of cancer treatment (Agrawal, 2014). However, few studies have focused on the late postoperative period for breast cancer. One of the main goals of rehabilitation involves improving functional capacity and quality of life. Although radiation therapy, chemotherapy, and surgery reduce the risk of local recurrence and extend overall survival in breast cancer survivors, the risk of long-term acute and chronic side effects may increase (Panchik et al., 2019). In this study, physical functional disabilities were present in the late postoperative period for breast cancer survivors, and their functional capacity and quality of life were negatively influenced (Martins da Silva & Rezende, 2014). The results of this study show that performing Pilates exercises during rehabilitation reduced the

KNOWLEDGE TRANSLATION

- The Pilates exercise program significantly improved functional capacity and quality of life among women who were at least one year postsurgery for breast cancer.
- Pain significantly decreased after 24 sessions among breast cancer survivors who participated in the Pilates exercise program.
- Pilates exercises constitute a new and promising method of physical rehabilitation for women following breast cancer surgery.

TABLE 2. Total Functional Capacity, Quality-of-Life, and Pain Scores at Admission and After 12 and 24 Sessions of Pilates Exercises (N = 44)

	At Admission			After 12 Sessions			After 24 Sessions		
Variable	**M**	**p**	**Cohen's d**	**M**	**p**	**Cohen's d**	**M**	**p**	**Cohen's d**
Functional capacity									
DASH	23.33	–	–	8.33	0.003	0.46	9.17	0.013	0.38
SPADI	20.62	–	–	4.47	0.002	0.46	8.75	0.0001	0.6
Quality of life									
EORTC QLQ-C30	57.5	–	–	52	0.033	0.32	46	0.001	0.81
EORTC QLQ-BR23	36	–	–	32.5	0.005	0.42	33	0.009	0.4
FACT-B	29.5	–	–	21	0.009	0.4	19	0.012	0.38
Pain									
Current pain	5	–	–	2	0.0001	0.64	0	0.0001	1.18
SPADI	2.6	–	–	1.7	0.016	0.36	1.4	0.0001	0.53
Visual analog scale	5	–	–	0.5	0.007	0.05	0	0.02	0.41

DASH—Disabilities of the Arm, Shoulder, and Hand Questionnaire; EORTC QLQ-BR23— European Organisation for Research and Treatment of Cancer Quality-of-Life Questionnaire–Breast Cancer Module; EORTC QLQ-C30—European Organisation for Research and Treatment of Cancer Quality-of-Life Questionnaire–Core 30; FACT-B—Functional Assessment of Cancer Therapy–Breast; M—median; SPADI—Shoulder Pain and Disability Index

Note. Functional capacity was measured using the DASH and SPADI; total possible scores on both measures range from 0 to 100, with higher scores indicating worse functional capacity. Quality of life was measured using the EORTC QLQ-C30, EORTC QLQ-BR23, and FACT-B; total possible scores on the EORTC QLQ-C30 range from 0 to 126, and scores on the EORTC QLQ-BR23 range from 0 to 92, with higher scores indicating worse quality of life, and total possible scores on the FACT-B range from 0 to 144, with higher scores indicating worse quality of life. Pain was measured using a numeric pain scale, the SPADI, and the visual analog scale; total possible scores for all measures range from 0 to 10, with higher scores indicating worse pain.

postoperative upper limb complications experienced by breast cancer survivors.

Pilates has received much attention during the past few years. Several studies report health improvements with training based on Pilates exercises, but no explicit analysis has been performed on complications experienced by breast cancer survivors during the late postoperative period after exclusive training (Pinto-Carral et al., 2018). This is the first study to demonstrate the efficacy of using Pilates exercises to improve functional capacity and quality of life and to decrease pain among women with breast cancer during the late postoperative period. The data indicate that informing patients about the possibility of performing Pilates exercises during rehabilitation and providing professional training are essential. In Brazil, Pilates exercise programs are not usually offered by public services and are a novelty for breast cancer rehabilitation. In addition, few studies have demonstrated the effects of Pilates exercises on pain, functional capacity, and quality of life for breast cancer survivors in the late postoperative period. Pilates exercises improved all variables in this study, demonstrating that this type of exercise is useful for rehabilitation. The implementation of a specific protocol of Pilates for patients with breast cancer is important, considering the necessity to improve functional capacity and quality of life. A review of the literature revealed that patients with breast cancer used Pilates to improve their quality of life, shoulder function, and body image, but no detailed exercise programs were implemented.

Limitations

This study has some limitations. Two limitations of the study are its longitudinal design and the fact that the participants were not blinded to the researchers, which may have introduced bias.

Implications for Nursing and Conclusion

The results of this study support engaging nurses in the ambulatory setting to thoroughly assess and provide ample care to patients who are navigating breast cancer complications during the late postoperative period. Implementing a Pilates exercise program during breast cancer survivors' rehabilitation can help to mitigate the negative effects of such complications. The results also suggest that it is important for oncology nurses to continue to explore the needs of breast cancer survivors to ensure the delivery of high-quality care. Performing 12 or 24 sessions of Pilates exercises can significantly improve pain, functional capacity, and quality of life for breast cancer survivors during the late postoperative period. Pilates exercises are a promising method of physical rehabilitation for patients with breast cancer that can help to improve their postoperative outcomes, self-sufficiency, and overall well-being.

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