



Effects of pilates exercises on functional capacity, flexibility, fatigue, depression and quality of life in female breast cancer patients: a randomized controlled study

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Background. There are very few randomized controlled studies on exercise in cancer patients. Consequently, there are no guidelines available with regard to the exercises that can be recommended and difficulties are encountered in the clinical practice as to which exercise is more suitable to the patients.

Aim. The purpose of this study was to investigate the impact of pilates exercises on physical performance, flexibility, fatigue, depression and quality of life in women who had been treated for breast cancer. **Design.** Randomized controlled trial. **Setting.** Out patient group, Department of Physical Medicine and Rehabilitation and Medical Oncology Department, University Hospital. **Population.** Fifty-two patients with breast cancer were divided into either pilates exercise (group 1) and control group (group 2).

Methods. Patients in Group 1 performed pilates and home exercises and patients in group 2 performed only home exercises. Pilates exercise sessions were performed three times a week for a period of eight weeks in the rehabilitation unit.

Main Outcome Measures. Subjects were assessed before and after rehabilitation program, with respect to, 6-min walk test (6MWT), modified sit and reach test, Brief Fatigue Inventory (BFI), Beck Depression Index (BDI) and the European Organisation for Research and Treatment of Cancer Quality of Life C30 (EORTC QLQ-C30) and EORTC QLQ BR23.

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Results. After the exercise program, improvements were observed in Group 1 in 6-minute walk test, BDI, EORTC QLQ-C30 functional, and EORTC QLQ-C30 BR23 functional scores ($P < 0.05$). In contrast, no significant improvement was observed in Group 2 after the exercise program in any of parameters in comparison to the pre-exercise period ($P > 0.05$). When the two exercise groups were compared, there were significant differences in 6MWT in pilates-exercise group ($P < 0.05$).

Conclusion. Pilates exercises are effective and safe in female breast cancer patients. There is a need for further studies so that its effect can be confirmed.

Clinical Rehabilitation Impact. This study addressed the effects of pilates exercise, as a new approach, on functional capacity, fatigue, depression and quality of life in breast cancer patients in whom there are doubts regarding the efficacy and usefulness of the exercise.

KEY WORDS: Exercise - Breast cancer - Quality of life.

Breast cancer is the most commonly diagnosed cancer among women, affecting more than 1.2 million individuals per year worldwide.¹ Early detection and improved treatments for breast cancer have resulted in increased survival rates; the current 5 year

survival rate is 88%.¹ Despite the increased survival rates experienced by women diagnosed with breast cancer, the disease itself and its treatment sequelae result in adverse side effects, such as decrease in functional capacity, fatigue, depression, upper extremity lymphoedema, neuropathy, immune system dysfunction, bone loss and deficits in upper extremity strength, flexibility and functioning.¹ These side effects ultimately lead to impairments in health related quality of life.² Systematic reviews and meta-analyses have shown that exercises (aerobic, resistance, Tai Chi Chuan) have a positive effect on the quality of life, cardio-respiratory fitness and fatigue.³⁻⁶ However, the number of studies on rehabilitation and exercise in cancer patients is very limited. As a result, there is no clear evidence as to which types of exercise are more effective in patients with breast cancer. In our clinical practice, we encounter difficulties in the recommendations to be given to cancer patients or patients' questions regarding exercise.

It has been shown that pilates exercises improves strength, flexibility and postural awareness among the general population.⁷ Although pilates exercises have traditionally been used for dancers, the method is becoming more popular for use throughout general physical therapy practice.^{8,9} There is only one study with small samples (N=4) in the literature on pilates exercise in breast cancer patients.¹⁰ In this study, Keays *et al.* showed that pilates exercises exercise decreased pain and increased mood, upper extremity function and range of motion and concluded that pilates exercise was a suitable exercise for patients with breast cancer. In the present study, we aimed to explore the effects of pilates exercises on functional capacity, flexibility, fatigue, depression and quality of life in female breast cancer who completed treatment.

Materials and methods

Sixty patients, aged 18-75 years and diagnosed with breast cancer were allocated into the study. They were recruited in the Physical Therapy and Rehabilitation Department, Oncology Hospital, and Supportive Care Unit of Ege University Hospital. Inclusion criteria were breast cancer with no evidence of recurrent or progressive disease, female sex, completion of treatment with surgery, radiotherapy and/or chemotherapy with or without current hormone treat-

ment, consent to participate in the study, and cognitive functions good enough to understand the questionnaires. Patients were excluded if they had lymphoedema, cardiac disease, uncontrolled hypertension, acute or chronic respiratory disease, uncontrolled diabetes mellitus, mental illness, infection, uncontrolled immune or endocrine abnormality, severe musculoskeletal impairment (inability to participate in the training regimen), engaging in a regular exercise program during the past 6 months.

Sixty patients were selected initially for this study. Six patients did not fulfil the criteria and therefore were excluded from the study. Two patients declined to participate in the study. Fifty two patients were randomized to the hospital-exercise program (Group 1, N=27) or the home-exercise program (Group 2, N=25) by a random numbers table. Ten patients in Group 2 failed to complete the program due to loss of interest, difficulty in commuting to the hospital, and medical problems. Twenty seven patients in Group 1 and 15 patients in Group 2 completed the study (Figure 1).

Data on the demographic data (age, education, employment, menopause age), and clinical variables (operation type, number of chemotherapy cycles, number of radiotherapy cycles, presence of adjuvant treatment) of the patients were obtained from the patients' medical records and patient query forms.

The following assessments were performed for all patients before the treatment and 8 weeks after the exercise by the same physician:

Six-minute walk test (6MWT): walking endurance was assessed using a 6-minute walk. Participants walked up and down a 20-m hallway for a period of 6 minutes, and the distance walked by each subject was recorded.¹¹

Modified Sit and Reach Test: participants sat on the floor with shoulders, head and buttocks against the wall and legs straight in front. A 12-inch sit-and-reach box was placed against the soles of the feet with the zero end of the measuring device toward the participants. Participants maintained head and shoulder contact with the wall while holding arms straight in front of the body to establish the starting position. Bending forward at the waist and maintaining straight legs, participants performed three trials by sliding their fingertips along the top of the measuring device. The best of the three trials was used as the final score.¹²

The brief fatigue inventory (BFI): BFI assesses the

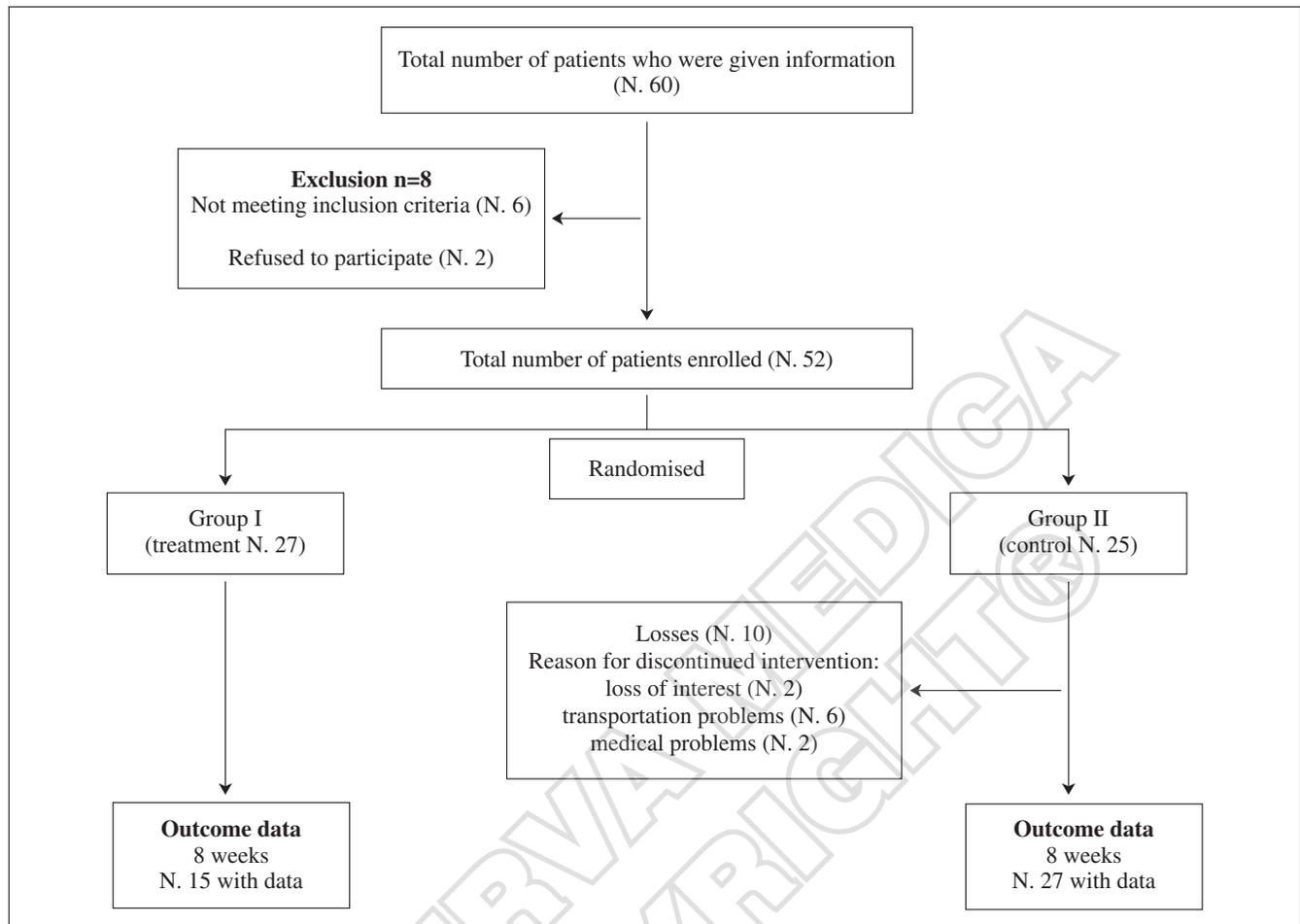


Figure 1.—Flow diagram of the study.

severity of fatigue and the impact of fatigue on daily routine activities. Zero point denotes no fatigue, while 1-3, 4-6, and 7-10 points indicate mild, moderate and severe fatigue, respectively.¹³

Beck depression inventory (BDI): BDI is a 21-item test presented in multiple choice format which purports to measure presence and degree of depression. Responses are made on a four point, minimally-anchored scale, ranging from 0 to 3, with 3 representing the most severe symptoms.¹⁴

The European Organisation for Research and Treatment of Cancer -EORTC QLQ-C30: EORTC QLQ-C30 is a 30-item scale that measures the quality of life of cancer patients in which respondents receive scores for functional scale, symptom scale and glob-

al health scale. High scores for functional and global health scales indicate a good quality of life while high scores in symptom scale represent a high level of problems.¹⁵

The European Organisation for Research and Treatment of Cancer -EORTC BR23: The QLQ-BR23 as a tumour specific tool consists of 26 items. These items pertain to the dimensions body image, sexuality, future perspective and side-effects related to different treatment modalities such as surgery, chemotherapy or radiotherapy. Questions also address sexual interest, sexual activity and sexual satisfaction. Each item is rated on a scale from 0 (not at all) to 4 (very much). With respect to functional scales, higher scores represent higher levels of functioning, while

higher scores in symptom orientated scales correspond to higher levels of symptoms.¹⁶

Exercise program: patients in Group 1 performed pilates exercise for an hour a day, 3 times a week for 8 weeks, under the supervision of a pilates exercise specialist physiotherapist in the rehabilitation unit. Before the pilates exercise, patients performed warm-up exercise in the pilates stances that is comprised of 10 repetitions of lateral neck flexion, elevation, flexion and rotation of the shoulders, body rotation, lateral flexion of the body, flexion of the knees, dorsal flexion of the ankle and mini squat. Following the warm-up exercises, patients were given pilates exercises including one leg stretch, double leg stretch, shoulder bridge, arm opening, hundreds, clam, hip twist and side kick (2 sets, 10 repetitions) when they were lying in the supine position and the intensity of the exercises increased every week. Correct execution of each exercise was demonstrated and monitored by the physiotherapist. Cool-down exercises comprised of breathing, stretching (shoulder and pectoral muscles, gastrocnemius-soleus, flexors and rotators of the hip, back muscles) and relaxation exercises were performed following the pilates exercises.

All patients (Group 1+Group 2) were given a 30-minute information about the breast cancer, lymphoedema, prevention of lymphoedema and daily living activities and a booklet showing the pictures of the exercise program. Exercises in this booklet were prepared by taking the lymph drainage into consideration and included range-of-motion, stretching and respiratory exercises. All patients were instructed to perform these exercises once everyday at home. Further, all patients (Group 1+Group 2) were recommended walking exercise of 20-30 minutes a day, 3 days a week for 8 weeks.

Follow up measurements

The patients were evaluated for functional capacity (6MWT), flexibility (modified sit and reach test), fatigue (BFI), depression (BDI), quality of life (EORTC QLQ-C30 and EORTC QLQ BR23) and complications. All of the measurements were repeated after 8 weeks by the same physician who had made the initial assessments.

Before enrolment, all subjects were informed about the study and signed informed consents were obtained. The local ethics committee approval was obtained as well.

TABLE I.—Demographical and clinical features of patients in Group 1 (pilates) and Group 2 (control group).

	Group 1 (N.=27)	Group 2 (N.=15)	P
Age (years, mean±SD)	48.52±7.62	49.73±8.71	0.97
Marital status (married, N, %)	18 (66.7)	15 (100)	0.42
Education (N, %)			0.24
Primary school	2 (7.4)	3 (20.0)	
Secondary school	6 (22.2)	8 (53.3)	
University	19 (70.4)	4 (26.7)	
Occupation (N, %)			0.64
Homemaker	6 (22.2)	5 (33.3)	
Retired	11 (40.7)	7 (46.7)	
Civil servant	7 (25.9)	2 (13.3)	
Labourer	2 (7.4)	0 (0)	
Others	1 (3.7)	1 (6.7)	
Age at menopause (years, mean±SD)	45.78±4.53	45.36±4.58	0.74
Type of operation			0.64
TM	26 (96.3)	15 (100)	
PM	1 (3.7)	0 (0)	
Time after diagnosis (months, mean±SD)	38.70±40.44	37.80±52.17	0.24
Number of chemotherapy cycles	5.54±1.91	5.93±2.19	0.42
Number of radiotherapy cycles	27.19±7.30	25.13±14.96	0.12
Adjuvant treatment (positive, %)	11 (40.7)	3 (20.0)	0.17

SD: standard deviation, TM: total mastectomy, PM: partial mastectomy.

Statistical analysis

All data were analyzed using the SPSS version 16 statistical package. Descriptive statistics were used to characterize the sample. A P-value below 0.05 was considered to be indicative of statistical significance. Baseline demographics and clinical characteristics were compared using the Mann Whitney U Test for numeric data and Fisher's Exact or Chi-Square Tests for nominal data. The non-parametric Wilcoxon test was used to compare groups with regard to parameters obtained before and after rehabilitation. Mann Whitney U test was also used to compare the differences between pre- and post-treatment in both groups.

Results

Demographic details of both Group 1 and Group 2 are presented in Table I. Both groups were comparable with regard to demographic (age, marital status,

TABLE II.—Comparison of the functional capacity, flexibility, fatigue, depression and quality of life before and after the exercise in patients in Group 1 (pilates) and group 2 (control).

	Group 1 (N=27)			Group 2 (N=15)			Between groups
	PreE (mean±SD)	PostE (mean±SD)	P	PreE (mean±SD)	PostE (mean±SD)	P	P
6 MWT	496.30±47.08	522.59±42.02	0.00	506.67±44.51	466.00±32.91	0.02	0.00
Sit and reach	8.04±10.20	8.93±7.33	0.25	4.97±4.36	5.00±4.76	0.86	0.21
BFI	6.63±4.14	5.58±4.67	0.14	7.75±5.68	6.55±4.42	0.82	0.66
BDI	7.41±5.82	5.63±6.38	0.01	9.53±12.10	6.8±9.48	0.25	0.47
EORTC QLQ-C30-Functional	77.07±14.96	83.26±14.70	0.03	76.73±21.67	78.00±20.54	0.53	0.33
EORTC QLQ-C30-symptom	18.98±12.18	20.89±21.49	0.43	23.20±23.91	13.20±9.99	0.21	0.48
EORTC QLQ-C30 global	70.16±20.58	77.02±21.81	0.19	62.64±29.27	63.78±23.80	0.91	0.79
EORTC QLQ-C30 BR 23-functional	77.81±16.62	84.39±10.47	0.04	73.27±20.08	75.83±10.59	0.85	0.26
EORTC QLQ-C30 BR 23-symptom	21.11±15.28	17.35±18.20	0.20	23.04±20.15	18.99±10.62	0.18	0.31

SD: standard deviation, PreE: preexercise, PostE: postexercise, 6 MWT: 6 minute walk test, BFI: Brief Fatigue Inventory, BDI: Beck Depression Inventory, EORTC QLQ: The European Organisation for Research and Treatment of Cancer Quality of Life.

education, occupation) and clinical variables (type of the operation, time after diagnosis, number of chemotherapy cycles, number of radiotherapy cycles, presence of adjuvant treatment) (Table I, $P>0.05$). Also, there were no differences in pre-exercise functional capacity (6 MWT), flexibility (sit and reach test), fatigue (BFI), depression (BDI) and quality of life scores (EORTC QLQ-C30 and EORTC QLQ-BR 23) between the two groups ($P>0.05$).

In Group 1, significant improvements in 6 MWT, BDI, EORTC QLQ-C30-functional and EORTC QLQ-C30 BR23-functional scores were observed after the exercise intervention ($P<0.05$, Table II). In Group 2, on the other hand, a significant decrease in 6 MWT was observed after the exercise intervention ($P<0.05$, Table II). There were no significant changes in other parameters in Group 2 ($P>0.05$, Table II).

When the two exercise groups were compared, there were significant differences in 6MWT in the pilates-exercise group ($P<0.05$) (Table II).

Following the exercise, none of the patients in Group 1 or 2 had any complications and none developed lymphoedema.

Discussion

The results of the present study led us to conclude that pilates exercise has positive effects on functional capacity, physical function and depression in female breast cancer patients who had completed treatment.

Cardiopulmonary capacity may be compromised in breast cancer survivals because of its pathology of the disease, therapeutic regimens, weight gain and inactivity secondary to treatment.¹⁷ Furthermore, decrease in cardiopulmonary capacity disturbs the quality of life as well. Research has provided preliminary evidence for safety, feasibility and efficacy of exercise training in breast cancer survivals.^{18, 19} Meta-analyses showed an increase in cardiopulmonary capacity with aerobic exercise and aerobic+progressive resistance exercises.^{1, 6} In the present study, we observed significant improvements in the 6-minute walk test and the physical function score of quality of life. On the other hand, the distance covered in 6-minute walk test was decreased in the control group. This was attributed to the fact that home walking program was questioned and reminded in each and every exercise session in the pilates exercise group by the physiotherapist and to the possibility of subjects in the control group not adhering to this walking program.

Review of the literature revealed only two studies in which flexibility exercises were given to patients with breast cancer.^{20, 21} Kolden *et al.*'s study reported a significant improvement in sit-and-reach test after an exercise program performed three times a week for 16 weeks.²¹ When we reviewed the literature, considering the positive effects of pilates exercise on flexibility, we found only one study that breast cancer patients were given pilates exercise.¹⁰ In this study, Keays *et al.* showed that pilates exercises exercise decreased pain and increased mood, upper extremi-

ty function and range of motion and concluded that pilates exercise was a suitable exercise for patients with breast cancer. In the present study, we did not find a significant increase in flexibility, as assessed by sit-and-reach. This may be due to the shorter period of exercise (8 weeks). However, since there are no studies in the literature that addressed the effects of this exercise on breast cancer patients, we believe that there is a need for more advanced studies that would explore the effects of pilates exercise on flexibility in breast cancer patients.

Fatigue has been reported to be a permanent complaint in cancer patients. It has been considered the most prevalent and distressing symptom of cancer therapy as well as the most unmanaged syndrome.²² Emotional distress, sleep disorders, and the physical effects of the disease have been implicated in development of fatigue.²³ In the meantime, it is known that it has a negative impact on the quality of life and functional capacity.²⁴ Structured physical training programs initiated during inpatient rehabilitation and continuously practiced in the time thereafter can improve symptoms of chronic fatigue and quality of life in breast cancer patients.²⁵ In our study, fatigue scores of all patients improved though the changes were not statistically significant. This was attributed to shorter period of time to exercise and other factors that might affect fatigue.

The prevalence of psychological problems is significant in women with breast cancer: 5-20% suffer from major depression at 12-24 months post-diagnosis and 12-23% have anxiety disorder.²⁶ Previous studies showed that exercise (aerobic, aerobic+resistance exercise) had beneficial effects on changes in scores of depression and anxiety.^{21, 27} In agreement with the literature, we found a decrease in depression score in the pilates exercise group. This improvement in the pilates exercise group may be explained by these patients' practicing in groups, comforting effects of pilates exercises and performance of the exercises under the supervision of a physiotherapist.

Throughout a cancer journey, breast cancer patients experience physical and psychological problems not only related to the disease but also to the treatment and these adversely affects the quality of life.²⁸ Consequently, an important goal for cancer patients is to improve the quality of life by maximizing functions affected by disease and its therapy.²⁹ Many of the randomized studies have examined the effect of exercise after a breast cancer diagnosis on physical and

emotional functioning and overall quality of life.^{1, 6} The majority of these studies have shown that physical activity is safe after diagnosis of breast cancer and is associated with improvements in physical and emotional quality of life. In our study, we found an increase only in the physical function scores of quality of life with exercise. Absence of an improvement in emotional scores can be due to the emotional impact of breast cancer experience continuing long after diagnosis. These problems often go undetected and resolved.²⁷ Similar findings have been reported in other studies.^{26, 30-32} In order to achieve emotional improvement, psychological support is as critical as rehabilitation and advanced studies should be carried out in that respect. We believe that appropriate rehabilitation and exercise programs given to the cancer patients would yield physiological and psychosocial improvements which, in turn, increase the quality of life.

Being the first randomized controlled study on the multidimensional effects of pilates exercise on functional capacity, flexibility, fatigue and depression in breast cancer patients is the major strength of the present study. Further, considering the exercise studies in cancer patients, the sample size also offers an advantage. Pilates exercise has very recently entered the literature. It was quite challenging to bring the patients to the hospital environment after the completion of the treatment for exercising, understandably, due to their psychology. We did not observe any adverse effects of complications in any of our patients after the treatment. In the meantime, all patients in the pilates exercise group stated that they were very satisfied with the program and that they did not have any difficulties. Moreover, significant improvements in their stance and posture were noticed by their circle of friends and family.

This study has certain limitations. The number of drop-outs in the control group, researchers not being blind to the group of the subjects, short duration of the exercise program and not being able to assess the effect on posture objectively are the constraints of the study.

There are very few randomized controlled studies on exercise in cancer patients. Consequently, there are no guidelines available with regard to the exercises that can be recommended and difficulties are encountered in the clinical practice as to which exercise is more suitable to the patients. This study addressed the effects of pilates exercise, as a new approach, on

functional capacity, fatigue, depression and quality of life in breast cancer patients in whom there are doubts regarding the efficacy and usefulness of the exercise. Based on our results, we conclude that pilates exercises is an effective and safe exercise on many of these parameters in breast cancer patients. It is possible that a significant difference was not observed because a home exercise program was also recommended to the control group. The results of this study need to be supported by future studies.

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