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*Case Report*

# New Strategy of Home-Based Exercise during Pandemic COVID-19 in Breast Cancer Patients: A Case Study

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**Abstract:** The COVID-19 pandemic has posed several challenges for the oncology health care system. The need to improve patients' Quality of Life (QoL) through exercise, which is related to survival and healing, has increased, especially during lockdowns. Technologies are often used to help with patient care as well as to monitor exercise training. This case study, developed during the pandemic period, aims to evaluate the effectiveness of a proposed home-based combined training (CT) regimen, supervised through online lessons, in increasing QoL and fatigue in breast cancer patients undergoing adjuvant therapy. Additionally, we evaluated the effect of exercise on psychological and functional parameters. Methods: Two breast cancer (BC) survivors were required to participate in 2 h/week of supervised and home-based CT for 16 weeks. Results: Improvements were found in the emotional function of QoL (10% in patient A; 70% in patient B) and in all variables of fatigue (physical fatigue 66% in patient A; 33% in patient B). Conclusion: The findings from this study revealed positive effects of CT on QoL and fatigue perception in BC women undergoing therapy. Both patients attended all training sessions with no adverse events, showing the sustainability of this training as an alternative and affordable method that is capable of improving patients' wellbeing.

**Keywords:** QoL; breast Cancer; physical activity; treatments; COVID-19

## 1. Introduction

A growing body of evidence support the effectiveness of physical activity (PA) in the management and survival of breast cancer patients either during or after treatment. Indeed, several studies have highlighted the positive effect of PA on Quality of Life (QoL), showing that it improves psychological, functional and cognitive functions [1–3]. In particular, combined training (CT) has been shown to induce more positive effects compared to other types of exercise intervention [2]. Despite these well-documented benefits, a breast cancer diagnosis is generally followed by a decrease in PA, with a large number of patients being unable to achieve the recommended level of PA [4]. Moreover, if on one hand the social distancing policies applied by different governments have contained the spread of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), on the other hand, they have worsened the condition of breast cancer survivors regarding PA and social supports [5]. Therefore, it is a priority to identify a new method to engage these patients in suitable and effective home-based PA programs.

Recently, with the aim of monitoring and improving fitness and healthy behaviors in patients with different diseases, several studies have highlighted the effects of e-health-based protocols, developed

using Internet resources, for monitoring and connecting these people [6,7]. To date, this new approach has been widely applied in the field of psycho-oncology, nutrition and physical activity to improve communication between patients and oncologists, to monitor patients' activities and to give telematics access to diagnosis or screening results, as well as to support patients during rehabilitation [8–10].

Although there is some evidence about on-line protocols used in rehabilitation [11], to the best of our knowledge, no studies have evaluated the effects of an exercise protocol performed at home using video lessons and supervised by a specialized trainer through video-calling. Therefore, the aim of the present case study was to evaluate the effectiveness of a 16-week home-based CT, performed and supervised by video-calling, on QoL and fatigue perception in two breast cancer patients undergoing adjuvant therapy. Moreover, we evaluated the effect of exercise on body image, fatigue, depression and anxiety, as well as on sleep disturbance and physical functions.

## 2. Materials and Methods

The study was approved by the Sapienza University of Rome's Ethical Committee (RIF.CE 5451_2019) in agreement with the Declaration of Helsinki. Informed consent was obtained from all subjects prior to enrollment. Participants were recruited from the Sant'Andrea UOC of Medical Oncology in Rome. In order to exclude possible complications related to sports, both patients underwent a medical examination, including anamnesis and electrocardiogram at rest (ECG), carried out by a specialist in sports medicine. In addition, participants were required to perform a battery of functional and psychological tests at the University of Rome "Foro Italico", supervised by a sport science specialist. Participants were required to take part in 16 weeks of home-based CT, monitored through WhatsApp video call, twice a week. Each session lasted 1 h. The patients' characteristics are listed in Table 1.

**Table 1.** –Baseline patients' characteristics.

| Subject | Patient A | Patient B |
|---|---|---|
| Age | 43 | 56 |
| BC type | Lobular carcinoma | Multifocal carcinoma |
| Therapy | RT + hormonal therapy | RT, chemotherapy and hormonal therapy |
| Surgery | QDT + sentinel lymph node Removal | Modified radical mastectomy |
| Comorbidity | No | No |
| Job | Worker | Housewife |
| Marital status | Divorced | Married |
| Kids | 2 | 1 |

**Note:** patients' baseline characteristics before starting the exercise protocol. RT= Radiotherapy; QDT= Quadrantectomy.

### *2.1. Quality of Life, Psychological and Fatigue Assessments*

QoL and fatigue were evaluated through the European Organization for Research and Treatment of Cancer quality of life questionnaire (EORTC-QLQ-C30) and EORTC-QLQ-FA12 questionnaires [12]. These are self-reported questionnaires, with specific questions on physical, emotional and cognitive aspects or problems related to pathology. The psychometric coefficient, utilized by medical doctors to assess general degree of fatigue, was calculated using the sum formula.

The Body Image Scale (BIS) was utilized to assess body image perception. This is a 10-item questionnaire about physical appearance and the feelings related to the changes that may have occurred due to disease or treatment. Each question can be answered as follow: "never", "little", "moderately", "greatly", and "I do not know". The total score is given by the algebraic sum of all items [13,14].

### *2.2. Functional Evaluations*

Body composition was evaluated using impedance equipment (DS Medical's Handy 3000) with a frequency of 50 Khz and 100 Khz, and patients' body mass index (BMI), fat mass (FM) and free fat mass (FFM) were analyzed. The hand grip test was used to assess the muscle strength of both arms using a

dynamometer (Jamar Plus®; Patterson Medical Ltd., Sutton-In-Ashfield, UK). This index is correlated to the general strength of the subject [15,16]. The functional strength of the lower limbs, transition movements, balance and risk of falling were tested through the 30 s sit-to-stand test [17]. Flexibility was assessed through two specific tests: the back stretch and the trunk rotation. The functional capacity was assessed through the 6 min walking test; this consists of walking for 6 min as quickly as possible and then measuring the distance covered [18]. The heart rate and the percentage of oxygen saturation were constantly monitored by specific devises. At the end of the test, fatigue perception was evaluated by the Borg CR10 scale.

### *2.3. Intervention*

From March to June 2020, using a smartphone with WhatsApp video-calling, the patient performed two lessons per week, lasting 60 min each, for a total of 32 sessions in 16 weeks. Each session was structured into 10 min of warm-up focused on neck, shoulder and trunk mobilization, 40 min of strength and aerobic exercises and 10 min of stretching and cool-down focused on shoulder, arm and trunk flexibility. The work intensity was between 50/70% of the maximum heart rate (HRmax), evaluated by a heart rate monitor provided to the patients by the training staff. Three different training programs were developed during the time in order to progressively increase the load and intensity.

#### 2.3.1. Program A

Program A lasted 4 weeks. The strength part was developed in circuits, without rest between the exercises and with 1 min of rest between circuits.

Circuit 1: 10 reps dumbbell goblet squat and 10 reps dumbbells biceps curls;
Circuit 2: 10 reps dumbbell press in sitting position and 10 reps calf raises;
Circuit 3: 10 reps dumbbell lying floor press and 10 reps body weight cossack squat.

At the end of each circuit, the fatigue perception was evaluated using the Borg scale. The aerobic part consisted of 8/10 min of moderate-intensity activity (65% HRmax), performing 20 step ups with the right leg and 20 step ups with the left leg, with 20 s of rest, then 20 V steps with the right leg and 20 V steps with the left leg, with 20 s of rest. Each exercise was performed twice.

#### 2.3.2. Program B

Program B lasted 6 weeks and consisted of 2 circuits based on strength exercises for the upper and lower body and one circuit composed of 3 multi-joint exercises to increase the intensity of the program. There was no rest between exercises and 1 min of rest between circuits.

- Circuit 1: 10 reps dumbbell goblet squat, 10 reps dumbbell press in sitting position, 10 reps dumbbell static lunges and 10 reps wall pushups;
- Circuit 2: 10 reps body weight hip-thrust, 10 reps dumbbell biceps curls, 10 reps heel-elevated bridge, 10 reps dumbbell rows;
- Circuit 3: 10 reps dumbbell thrusters, 10 reps dead-lift plus rows with dumbbells, 10 reps dynamic lunges plus biceps curls with dumbbells.

The aerobic part consisted of steps exercises with music at 65% of HRmax. Every two weeks, this part was made 5 min longer.

#### 2.3.3. Program C

Program C lasted 6 weeks. The volume of exercises was increased rather than the load.
The strength part of this program was developed as follows:

- Circuit 1: 12 reps dumbbell goblet squat, 12 rep dumbbell press in sitting position, 10 reps static lunges plus lateral raises with dumbbells and 12 wall push-ups.

- Circuit 2: 20 s elbows-plank, 10 reps bear walking plank, and 10 alternating reps of mountain climbers.
- Circuit 3: 10 reps dumbbell floor press plus hip extension, 12 reps dumbbell biceps curls, 10 reps per leg of one-leg bridge and 12 reps dumbbell rows.
- Circuit 4: The same as circuit 2–20 s elbows-plank, 10 reps bear walking plank, and 10 alternating reps of mountain climbers.
- Circuit 5: 12 reps dumbbell thrusters, 12 reps dead-lift plus rows with dumbbells, 12 reps dynamic lunges plus biceps curls with dumbbells.

The aerobic part was similar to the previous section, but eight march times and two alternating kicks plus right punch and left kick plus left punch were added. At the end of the protocol, this part lasted 20 min at 65/70% of HRmax. The heart rate was monitored at the end of each circuit and at the end of the aerobic part using a Polar M430. In addition, the patients had to indicate the perceived effort on the Borg scale. In this way, the workload and the status of the patients was monitored during each training session.

## 3. Results

For each patient, psychological and functional pre and post data were reported, and for each patient, the differences were evaluated through the percentage variation considering the initial data as the reference.

### *3.1. Quality of Life, Psychological and Fatigue Evaluation*

In Table 2, we present patient's A results for EORTC-QLQ-C30, EORTC FA-12 and BIS. Concerning the functional part of the first questionnaire, the data show improvements in emotional and social function of 10.01% and 20%, respectively, whereas there is a decrease in cognitive function (16.67%). No differences are observed regarding physical function, role function and global health. The symptoms scale of EORTC QLQ-C30 does not report differences between pre and post values in this patient. The fatigue questionnaire results show a reduction in physical fatigue (66.65%), and in cognitive fatigue (100%). The body image score decreased by 40% after the intervention. EORTC QLQ-C30, EORTC FA-12 and BIS results of patient B are reported in Table 3. The functional part of the C30 questionnaire shows great improvements in terms of role, emotional and cognitive functions of 20%, 71.44%, and 24.99%, respectively. The global health status improved by 250%. Regarding the symptoms, the data show a relevant reduction in fatigue (33.33%). No differences are reported in dyspnea and there is a small increase in insomnia, although this may be related to the pandemic period. A great decrease in fatigue perception is evidenced by the EORTC FA-12; indeed, there is a reduction of 50% in physical fatigue and cognitive fatigue and a decrease of 100% of emotional fatigue and interference with daily life. The BIS reports a decreasing score (42.85%) after training, which reveals an improvement in body perception.

### *3.2. Functional Evaluation*

The functional evaluations are reported in Tables 4 and 5 At the end of the CT protocol, flexibility was significantly improved: patient A reported an improvement in the trunk rotation test of 35.71% on the right side and 30.91% on the left side, whereas patient B reported an improvement of 77.27% on the right side and 90.24% on the left side. The scratch test showed improvements in both patients: the results for patient A showed a decrease of 21.05% on the right side and of 13.63% on the left side; whereas in patient B, the decrease was 36% on the right side and 43.47% on the left side. In agreement with the body composition results, patient A increased both their free fat mass (0.89%) and fat mass (6.80%), and consequently their BMI (2.11%). In contrast, patient B, at the end of the CT protocol, significantly improved their body composition, with a 12.50% decrease in fat mass and 2.46% in free fat mass, leading to a 2.47% decrease in BMI. Concerning the functional tests of patient A, the right-hand

grip test, the 6 min walking test and the 30 s sit-to-stand test showed an increase of 27.37%, 8.93% and 12%, respectively, after the training period. The left-hand grip decreased by 4.35% from the beginning. In patient B, the data show an improvement in the sit-to-stand test and left hand grip tests after the intervention (64.71%; 10.92%), while a slight decrease in the 6 min walk test and right-hand grip test was found (2.73% and 10%, respectively).

**Table 2.** Patient A psychological evaluations.

| EORTC-QLQ-C30 Functional | Pre | Post | Diff (%) |
|---|---|---|---|
| **Physical Function** | 93.3 | 93.3 | 0.00 |
| **Role Function** | 100.0 | 100.0 | 0.00 |
| **Emotional Function** | 83.3 | 91.7 | +10.01 |
| **Cognitive Function** | 100.0 | 83.3 | −16.67 |
| **Social Function** | 83.3 | 100.0 | +20.00 |
| **Global Health** | 33.3 | 33.3 | 0.00 |
| **EORTC-QLQ-C30 Symptoms** | **Pre** | **Post** | **Diff (%)** |
| **Fatigue** | 33.3 | 33.3 | 0.00 |
| **Pain** | 0.0 | 0.0 | 0.00 |
| **Insomnia** | 66.7 | 66.7 | 0.00 |
| **EORCT FA-12** | **Pre** | **Post** | **Diff (%)** |
| **Physical Fatigue** | 20.0 | 6.7 | −66.65 |
| **Emotional Fatigue** | 11.1 | 11.1 | 0.00 |
| **Cognitive Fatigue** | 16.7 | 0.0 | −100.00 |
| **Interference with Daily Life** | 0.0 | 0.0 | 0.00 |
| **Social Sequelae** | 0.0 | 0.0 | 0.00 |
| **Body Image Questionnaire** | **Pre** | **Post** | **Diff (%)** |
| **Score (0–30)** | 5 | 3 | −40.00 |

**Note:** –Patient A EORTC-QLQ-C30, EORTC FA-12 and body image questionnaires before (pre) and after (post) intervention, difference between pre and post expressed in %. Abbreviation: diff= difference.

**Table 3.** Patient B psychological evaluations.

| EORTC-QLQ-C30 Functional | Pre | Post | Diff (%) |
|---|---|---|---|
| **Physical Function** | 86.6 | 86.7 | 0.00 |
| **Role Function** | 83.3 | 100.0 | +20.00 |
| **Emotional Function** | 58.3 | 100.0 | +71.44 |
| **Cognitive Function** | 66.6 | 83.3 | +24.99 |
| **Social Function** | 100.0 | 100.0 | 0.00 |
| **Global Health** | 33.3 | 116.7 | +250.05 |
| **EORTC-QLQ-C30 Symptoms** | **Pre** | **Post** | **Diff (%)** |
| **Fatigue** | 33.3 | 22.2 | −33.33 |
| **Pain** | 0 | 0 | 0.00 |
| **Insomnia** | 33.3 | 33.3 | 0.00 |
| **EORCT FA-12** | **Pre** | **Post** | **Diff (%)** |
| **Physical Fatigue** | 40.0 | 20.o | −50.00 |
| **Emotional Fatigue** | 33.3 | 0 | −100.00 |
| **Cognitive Fatigue** | 66.7 | 33.3 | −50.01 |
| **Interference with Daily Life** | 33.3 | 0 | −100.00 |
| **Social Sequelae** | 66.7 | 66.7 | 0.00 |
| **Body Image Questionnaire** | **Pre** | **Post** | **Diff (%)** |
| **Score (0–30)** | 21 | 12 | −42.85 |

**Note:** –Patient B EORTC-QLQ-C30, EORTC FA-12 and body image questionnaires before (pre) and after (post) intervention, difference between pre and post expressed in %. Abbreviation: diff= difference.

**Table 4.** Patient A functional evaluations.

| Value | Pre | Post | Diff (%) |
|---|---|---|---|
| **Body Mass Index** | 19.0 | 19.4 | +2.11 |
| **Fat Free Mass (kg)** | 37.7 | 38.0 | +0.80 |
| **Fat Mass (kg)** | 10.3 | 11.0 | +6.80 |
| **30 s sit-to-stand** | 25.0 | 28.0 | +12.00 |
| **6 min walking test (m)** | 560.0 | 610.0 | +8.93 |
| **Hand Grip Right** | 27.4 | 34.9 | +27.37 |
| **Hand Grip Left** | 27.6 | 26.4 | −4.35 |
| **Trunk Test Right (cm)** | 56.0 | 76.0 | +35.71 |
| **Trunk Test Left (cm)** | 55.0 | 72.0 | +30.91 |
| **Scratch Test Right (cm)** | 19.0 | 15.0 | −21.05 |
| **Scratch Test Left (cm)** | 22.0 | 19.0 | −13.63 |

**Note:** Patient A functional evaluations before (pre) and after (post) intervention; difference between pre and post expressed in %. Abbreviation: diff = difference; kg = kilograms; cm = centimeters.

**Table 5.** Patient B functional evaluations.

| Value | Pre | Post | Diff (%) |
|---|---|---|---|
| **Body Mass Index** | 24.3 | 23.7 | −2.47 |
| **Fat Free Mass (kg)** | 44.8 | 43.7 | −2.46 |
| **Fat Mass (kg)** | 15.2 | 13.3 | −12.50 |
| **30 s sit to stand** | 17.0 | 28.0 | +64.71 |
| **6 min walking test (m)** | 550.0 | 535.0 | −2.73 |
| **Hand Grip Right (kg)** | 30.0 | 27.0 | −10.00 |
| **Hand Grip Left (kg)** | 22.9 | 25.4 | +10.92 |
| **Trunk Test Right (cm)** | 44.0 | 78.o | +77.27 |
| **Trunk Test Left (cm)** | 41.0 | 78.0 | +90.24 |
| **Scartch Test Right (cm)** | 25.0 | 16.0 | −36.00 |
| **Scratch Test Left (cm)** | 23.0 | 13.0 | −43.47 |

**Note:** Patient B functional evaluations before (pre) and after (post) intervention; difference between pre and post expressed in %. Abbreviation: diff = difference; kg = kilograms; cm = centimeters.

## 4. Discussion

The results of this case study indicate that this CT protocol can improve QoL and fatigue perception in breast cancer patients undergoing adjuvant therapy. Both patients performed all sessions without adverse events and dropping out, evidencing the sustainability of an online protocol using video-calling and supervised by a specialized trainer. Moreover, the positive effect in several functional and psychological parameters supported the suggested improvements of QoL in these patients, even during the lockdown, which could be a stressful period. The results concerning QoL found in the present case study were in line with those reported in the literature [19–21]. In particular, data obtained from patient B supported the hypothesis of a possible positive effect of CT on role function, emotional function and cognitive function. Other studies [22,23] did not report significant changes in EORTC-QLQ-C30 symptoms in BC women after a CT protocol, which seems to be more in line with patient A data. The result concerning global health in patient A may be due to the good starting point of the patient, that did not allow for great differences in this score. The analysis of our data showed an improvement in physical and general fatigue in both patients. Fatigue is the most common symptom reported by BC patients, which strongly affects QoL [24,25]. These improvements in fatigue variables, particularly in cognitive and physical fatigue, were in accordance with the findings reported by several studies [23,26]. In both patients, the significant decrease in emotional fatigue supports the positive impact of online CT for this disabling symptom. Despite the fact that they were living a difficult psychological moment due to the pandemic COVID-19 period, it may be possible that the patients felt supported and not left alone during these hard times. Lastly, this case study reported contrasting findings on cognitive fatigue, which were not in line with several studies supporting the

effectiveness of CT regarding this symptom [20,22]. Indeed, patient A's score increased, while in patient B, it significantly decreased. These findings may be related to the different levels of stress caused by the changes in daily life routines, work modality and childcare during the pandemic period, which were present in both participants. In particular, patient A lived with two young daughters and she was divorced, whereas patient B was unemployed and lived with one working daughter. The positive results observed in patient B was highlighted by the EORTC FA-12, which reported improvements in all variables. Both patients showed an increase in body image perception after training, which is an important endpoint in Quality of Life evaluation in these patients [15].

Moreover, the functional effects of CT were in line with previous studies [21,27]. Indeed, our data reported increased muscular strength, flexibility and fitness in both patients. Particularly, strength was improved by following this type of training, probably due to a well-structured strength part, in term of volume, intensity and time. Despite body weight and fat mass often increasing in patients with cancer, particularly for those undergoing treatment, our data, in accordance with De Luca, V., et al. [28], showed an increase of free fat mass in both patients after training. This could be due to the type of training chosen, which was designed with an intensity and volume that would lead to metabolic adaptations, and therefore an improvement in body composition. At the end of the training period (16 weeks), open questions were asked to patients, such as "Do you feel that this program helped you to feel better?" "Do you think that the training helped you to accept and better understand your body?" "Do you think that the video-call lessons helped you not to give up training?". Both participants replied that they felt better, especially in terms of tiredness and fatigue. In particular, after training, the patients reported feeling less fatigue, especially when they started from a higher sensation of fatigue. Patient B, who showed more changes in body composition, felt more toned, and both women indicated that they felt stronger and more resilient than before the CT protocol.

## 5. Conclusions

Our results highlight the effectiveness of a monitored online CT protocol in improving QoL and fatigue perception in BC patients undergoing therapy. This training protocol is well characterized in terms of frequency, intensity, volume and equipment, respecting the needs of each individual. Indeed, both patients concluded the protocol without adverse events, highlighting an improvement in their general status. Therefore, doctors and/or health care professionals should feel comfortable in providing a recommendation for this online CT protocol to breast cancer survivors under their care, mainly in patients who are unable or unmotivated to go to the hospital or gym. Moreover, the COVID-19 pandemic period has highlighted the need for alternative and effective strategies to maintain and improve the wellbeing of this frail population. Findings from this study will provide useful information for investigators conducting exercise trials in cancer populations, clinicians who are treating women diagnosed with breast cancer and exercise professionals who are developing community-based exercise programs for cancer survivors. Although further studies with a higher sample size and a control group are needed to strengthen our results, this case study provides some of the first evidence showing that a specific and personalized home-based exercise program could represent a new alternative approach to physical activity for cancer survivors, ensuring greater participation, safety and efficacy for their health status. Finally, in order to make this new approach to exercise more usable by stakeholders, new studies are in progress to design a digital platform that is dedicated exclusively to breast cancer patients undergoing therapy.

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