Original Article

Active lifestyle promotion with home-based exercise in breast cancer survivors

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ABSTRACT

Background: In cancer survivors, quality of life, weight management and physical activity levels are growing areas of interest, also considering such parameters may offer protection to cancer recurrence. Research question: In this study, we aimed to objectively verify whether a home-based exercise program is effective in weight management of a cohort of breast-cancer survivors. Type of study: Experimental cohort observational study. Methods: We enrolled 13 women (age 49.1±5.5, height 163±7.3 cm) and evaluated habitual physical activity levels. Afterwards we compared the baseline aerobic capacity by 6 Minutes Walking Test (6MWT), flexibility, grip and lower limbs strength and body composition, to the same parameters measured after 40 days of unsupervised exercise. Results: At baseline (T0), patients displayed a moderate level of physical activity and were overweight. After 40 days of unsupervised exercise (T1), we observed improvement of all analyzed parameters with statistical significance in waist circumference (T0=0.57±0.1 cm, T1=0.55±0.1 cm; $p<0.01$), distance walked in 6 MWT (T0445.4±168.1 m, T1=534.6±151.5 m; $p<0.05$), 30 '' Chair test (T0=14.8±5.6 rep, T1=16.3±4.9 rep; $p<0.05$). Conclusions: Home-based unsupervised exercise in breast-cancer survivors yielded short-term efficacy in all analyzed parameters. Efficacy at long-term and a possible effect in reducing the risk of tumor relapse remain to be elucidated in larger cohorts with longer and multidisciplinary follow up. **Key words:** PHYSICAL ACTIVITY, ONCOLOGY, UNSUPERVISED EXERCISE, LIFESTYLE

Cite this article as:
Mascherini, G., Giannelli, C., Ghelarducci, G., Degl'Innocenti, S., Petri, C., & Galanti, G. (2017). Active lifestyle promotion with home-based exercise in breast cancer survivors. *Journal of Human Sport and Exercise, 12*(1), 119-128. doi:10.14198/jhse.2017.121.10

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Submitted for publication November 2016
Accepted for publication May 2017
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

doi:10.14198/jhse.2017.121.10

INTRODUCTION

Cancer is the second cause of death after cardiovascular diseases. In particular, breast cancer is the most prevalent tumor in females (Capocaccia et al., 2015; Dal Maso et al., 2014). This prevalence is steadily increasing due to screening strategies which allow to recognize early stages of disease (Francisci et al., 2009).

Women who survivor to breast cancer are at risk of increased body weight due to drug therapies, a sedentary lifestyle, muscle fatigue and psychological factors (Cramp and Byron-Daniel, 2012). The body fat is now acknowledged as a risk factor for many diseases, including cancer survivors that does not incur in a relapse (Sheean, 2012).

The tendency to accumulate body fat in these subjects can be counteracted by the improvement of eating habits and the increase of the weekly physical activity level (McTiernan, 2008). The increase of the daily amount of exercise has numerous effects both physiologically and psychologically (Schmitz, 2011; Schmitz et al., 2010) so that they could both improve the quality of life and also reduce the risk of developing chronic diseases (Annunziata et al. 2015).

The supervised exercise has shown remarkable effectiveness, but is associated to poor compliance at long term. To change the style of life in terms of physical activity it is necessary to create a model that allows long-term therapeutic efficacy (Bluethmann et al., 2015). Unsupervised approach, in comparison with supervised, allow a reduction of the cost related to the treatment of not communicable disease with exercise therapy.

The purpose of this study is to verify the initial effectiveness of an exercise program unsupervised in a sample of women who underwent surgery after breast cancer.

MATERIALS AND METHODS

Study design
Experimental cohort observational study.

Participants
Inclusion criteria
Participants included in the study met the following inclusion criteria: 1) female, 2) age 21-65, 3) BMI > 25 kg/m2, 4) history of surgery for breast cancer, and 5) having completed treatments as chemotherapy, radiation for breast cancer (with or without maintenance therapy) within the last 3 months to 5 months. Participants were required to provided consent and have a letter of approval to participate from their oncologist and sports physician.

Exclusion criteria
Participants were excluded from the study if they reported a condition likely to influence treatment outcomes, their ability to participate in the treatment protocol, follow-up visit performed earlier than 30 and later than 40 days from the first visit, or for which physical activity behavior changes are contraindicated. Participants were also excluded if they were taking antipsychotic medications or another weight-loss strategy.

Enrollment lasted from January 2016 to June 2016. The program was attended by 25 breast cancer survivors with anticancer drug treatment, hormone replacement in addition to any radio - chemotherapy individualized based on histology. The study population included 13 women (49.1±Active 5.5 yrs, 163±7.3 height), 5 subjects were excluded because they did not return to follow-up and 7 because follow-up was scheduled after the enrollment period.

Procedures

The evaluation consisted of two different time points:

1. First visit (T0): patient's assessment and exercise prescription; consisting of two distant events in a week (day 1 and day 7): in day 1 absolute contraindications to physical exercise were excluded by a sports physician and body composition analysis was made (Mascherini et al., 2015), functional assessment was performed and finally were given an accelerometer (to be kept for one week) in order to assess physical activity level before to start the program. In day 7 the exercise prescription was administered and the date of follow-up visit was established.

2. Follow up visit (T1): verification of the adherence to treatment and the effectiveness of the program (30-40 days from the first visit). During follow up the body composition measurements and the functional e valuation were performed.

Body composition

<u>Anthropometry and Circumferences</u>

Weight was measured to the nearest 0.1 kg and height to the nearest 0.5 cm (seca gmbh &Co.), BMI was calculated as body mass divided by height squared (kg/m2).

Circumference measures were made with a tape metric (Holtain Limited, 1.5m Flexible Tape) at waist, hip and biceps (Welborn et al., 2003):

- waist: the measurement is taken at the narrowest level, or if this is not apparent, at the midpoint between the lowest rib and the top of the hip bone (iliac crest);
- hip: this measurement is taken over minimal clothing, at the greatest protrusion of the gluteus muscles. The subject stands erect with their weight evenly distributed on both feet and legs slightly parted without tensing the muscles;
- biceps: the arm is relaxed and the circumference is taken at the level of the mid-point between the acromion and the olecranon processes.

<u>Skin fold thickness</u>

Skin fold measurements are widely utilized to assess body fat mass. Measurements were taken in eight different anatomical sites around the body (Marfell-Jones et al., 2012) using calipers (Holtain, Limited Tanner/Whitehouse Skinfold Caliper): triceps, biceps, sub scapula, supra Ilium. The sum of the four sites and body fat mass (kg) was made (Durnin and Womersley, 1974).

<u>Bio Impedance Analysis (BIA)</u>

Body impedance is generated in lean tissues as an opposition to the flow of an injected alternate current. Bioelectrical impedance was measured with a phase-sensitive impedance plethysmograph (BIA 101 Sport Edition, Akern, Florence, Italy). The device emits an alternating sinusoidal electric current of 800 mA at an operating single frequency of 50 kHz, standard whole-body tetra polar measurements were performed according to manufacturer guidelines (Foster and Lukaski, 2996).

Resistance (Rz, Ω) is the opposition to the flow of an injected alternating current, Reactance (Xc, Ω) is the dielectric or capacitive component of cell membranes and organelles, Phase Angle (PA, in degree) defined as ratio between Rz and Xc or between intra and extracellular volumes (Kyle et al., 2004).

From the values of Rz and Xc, through regression equations, the following body compartments are estimated: Fat Free Mass (FFM), Body Cellular Mass (BCM), Extra Cellular Mass (ECM), Total Body Water (TBW), Extra Cellular Water (ECW), Intra Cellular Water (ICW).

Functional evaluation

Six Minute Walking Test (6 MWT)

The 6MWT is a practical simple test that requires a 100-ft hallway but no exercise equipment or advanced training for technicians. This test measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 minutes (6 MWD). However, because most activities of daily living are performed at sub maximal levels of exertion, this test may better reflect the functional exercise level for daily physical activities (Solway et al., 2001). The parameters recorded during 6 MWT were: distance covered, Peak Heart Rate with heart rate monitor, Systolic and Diastolic blood pressure at rest and at the end of the test and Self Perception of Effort (CR10).

Muscle Fitness

Flexibility and muscle strength evaluation were performed with easily executable and reproducible tests in an outpatient setting as Sit & Reach for flexibility (Mayorga-Vega et al., 2014), Hand Grip test to estimate the overall static strength of the upper limbs (Gomes et al., 2014) and Chair Test was used to assess the strength of the lower limbs (Rossi et al., 2016).

Accelerometers

An accelerometer (SenseWear Pro3 Armband) was used for a period of one week to quantify the daily spontaneous physical activity and calculate how much a subject moves and consumes daily in terms of calories. Thus it becomes possible to prescribe an extra dose of daily exercise to raise the levels of daily physical activity (PAL) (Calabrò et al., 2014).

The parameters were:
- Total energy expenditure Kcal per day
- Kcal> 3 METS expenses per day
- PAL (Physical Activity Level) defined as total energy expenditure/resting metabolic rate
- Steps per day
- Time spent in sedentary behaviors 1 to 1.49 METs (min)
- Light physical activity 1.5 to 2.99 Metabolic Equivalent of Task (METs) mild physical activity (min)
- Moderate physical activity 3 to 5.99 METs (min)
- Vigorous physical activity> 6 METs (min)

Training program

Training program consisted of two aspects that had to be integrated each other. The first one was the number of daily steps derived from accelerometer assessment, the second a fast walking activity in terms of weekly frequency, duration of single session and intensity derived from 6 MWT. Fast walking parameters were determined individually: starting from Peak Heart Rate during the 6MWT and crossing this value with the value of CR 10 provided by the patient, the meters and the difference in blood pressure at the end of the 6MWT, the intensity was prescribed in terms of heart rate and CR 10. Duration of the session and weekly frequency were established, starting from thirty minutes five times a week (150 minutes per week as guidelines) (Chyn and Halnon, 2016).

Every patient received the training program at the end of the first visit and was explained how to perform trough the experience done during the assessments.

Analysis

Data were expressed as mean ± standard deviation. Data before and after 40 days of exercise were compared, statistical significance was assessed using a Paired-Sample t test, P values of less than 0.05 were considered statistically significant. The data were analyzed using the statistical package IBM SPSS 16.0 Statistics for Windows. (SPSS Inc., Chicago, IL, USA).

RESULTS

At baseline, patients had parameters amenable of improvements with physical exercise. The accelerometer highlighted a moderately active sample (table 1, PAL=1.5±0.1, daily steps=8569.3±2107.1). Initially the sample is in an overweight condition (26.5±3.6 kg/m2) with waist circumference (92.4±8.5 cm) and waist-height ratio (0.57±0.1) at the upper limit. Total body fat is about 33,5% of body weight and extracellular water is 49% of total body water (table 2). Functional parameters were at the lower limits (table 3).

During the follow up we assessed statistically significant improvements in the following parameters:

- Waist circumference from 92.4±8.5 cm to 89.5±7.9 cm; $p<0.01$.
- Waist/height from 0.57±0.1 to 0.55±0.1; $p<0.01$.
- 6 MWT distance with the same perceived of effort from 445.4±168.1 m to 534.6±151.5 m; $p<0.05$.
- Chair test from 14.8±5.6 repetition to 16.3±4.9 repetition; $p<0.05$.

Table 1. Physical activity parameters before to start exercise program

	T0
Energy expenditure (Kcal)	2169.2±214.3
Energy expenditure > 3 METS (Kcal)	307.2±129.9
PAL	1.5±0.1
Steps/day	8569.3±2107.1
Sedentary behaviors (minutes/day)	1012.1±116.8
Light physical activity (minutes/day)	298.1±77.1
Moderate physical activity (minutes/day)	70.4±30.9
Vigorous physical activity (minutes/day)	0.5±1.1

Table 2: anthropometric parameters and body composition analysis before to start exercise program and during follow up after 40 days of training

	T 0	T 1	p value
Anthropometric parameters			
Weight (kg)	70.3±9.3	69.5±9.0	0.07
BMI (kg/m^2)	26.5±3.6	26.1±3.2	0.08
Waist circumference (cm)	92.4±8.5	89.5±7.9	*<0.01*
Waist c./height	0.57±0.1	0.55±0.1	*<0.01*
Hip circumference (cm)	106.2±8.7	104.2±8.8	0.08
Skinfold thickness			
Biceps circumference (cm)	31.2±3.1	30.7±2.5	0.12
Biceps skinfold (mm)	14.6±4.2	14.2±4.7	0.74
Triceps skinfold (mm)	26.5±3.0	25.8±5.1	0.24
Sub scapula skinfold (mm)	22.2±3.7	21.8±3.6	0.55
Sopra Ilium skinfold (mm)	24±5.6	24.3±2.4	0.68
Skinfolds sum (mm)	87.3±8.9	86.1±9.1	0.55
Fat mass (kg)	23.5±7.2	22.8±7.8	0.29
Bioimpedance			
Resistance (ohm)	563.8±60.1	564±69.7	0.99
Reactance (ohm)	53.3±9.2	55.1±9.4	0.46
Phase Angle (°)	5.4±0.5	5.6±0.7	0.32
Fat Free Mass (kg)	46.8±3.6	46.7±3.1	0.86
Body Cellular Mass (kg)	23.5±2.0	24±2.2	0.49
Extra Cellular Mass (kg)	23.2±2.3	22.7±2.6	0.35
Total Body water (l)	34.3±2.8	34.2±2.5	0.85
Intra Cellular Water (l)	17.6±1.5	17.8±1.5	0.54
Extra Cellular Water (l)	16.8±1.8	16.4±2.0	0.42
Resting Metabolic Rate (kcal)	1432.6±57.2	1444.3±63.4	0.50

Table 3: functional parameters before to start exercise program and during follow up after 40 days of training

	T 0	**T 1**	**p value**
Rest Heart Rate (Bpm)	85.5±14.7	87.1±16.8	0.61
Rest Systolic Blood Pressure (mmhg)	112.3±17.4	109.6±11.3	0.61
Rest Diastolic Blood Pressure (mmhg)	73.8±16.2	72.7±9.3	0.82
6 MWT (m)	445.4±168.1	534.6±151.5	*<0.05*
CR 10	4.7±1.2	4.6±0.9	0.44
Heart Rate 6 MWT (Bpm)	107.4±14.6	112.2±17.8	0.13
Systolic Blood Pressure 6 MWT (mmhg)	120.8±14.6	121.5±14.1	0.88
Diastolic Blood Pressure 6 MWT (mmhg)	77.7±12.4	76.9±11.3	0.83
30 " Chair test (rip.)	14.8±5.6	16.3±4.9	*<0.05*
Handgrip (kg)	23.8±2.9	23.2±2.7	0.27
Sit & Reach (cm)	1.7±11.6	6.2±7.5	0.12

DISCUSSION

According to the World Cancer Research Fund International (WCRF) weight gain, overweight and obesity increase the risk of neoplastic recurrence, therefore a healthy weight becomes an important action (Torre et al., 2016).

In this setting, the WCRF recommends to maintaining the BMI and waist circumference within the range, be physically active and limit sedentary behaviors (defined by a Physical Activity Level lower than 1.4).

It is currently acknowledged that physical rehabilitation has a positive effect on the mobility of the shoulder and upper extremity in breast cancer survivors with lymph edema.

Evidences on efficacy of life-style change in cancer survivors are still scarce. Yet life-style changes might have a paramount importance in improving the quality of life, general health and life expectancy in patients operated for breast cancer, also considering that long-term survival has improved in recent years. In this setting, physical exercise supervised by a dedicated professional has been found to have a beneficial effect which is evident at long-term but tends to wane with time due to loss of compliance (Battaglini et al., 2014).

Implementing the patient's skill to perform autonomously physical exercise could represent a strategy to maintain long-term compliance and hence efficacy, including the period of chemotherapy. Indeed, this period is burdened by frequent drug administration with possible side effects that lead inevitably to inactivity, entering a vicious cycle characterized by increased muscle fatigue, reduction of the daily activities, worsened quality of life. Therefore physical exercise during adjuvant treatment of breast cancer can and must be considered as an intervention of self-support therapy yielding a better physical shape and also a greater ability to perform activities of daily life (Markes et al., 2006).

To obtain optimal adherence, the subject must be made aware of the goal of the program and taught to self-monitor exercise. Professional should teach patients to "export" their learnings to unsupervised contexts.

Exercise appears to be safe for the majority of patients with breast cancer and the improvement of the physiological, psychological and functional parameters can be achieved with the participation to a regular moderate exercise.

Aerobic exercise seems to be better in order to reduce muscle fatigue in comparison with resistance exercise (Cramp and Byron-Daniel, 2012). We adopted aerobic exercise instead of resistance exercise because our first goal was reaching regularity and maximizing compliance. Resistance exercise would have needed a new motor learning that could discourage the adherence.

Although our results should be considered preliminary due to the short duration of the study, we demonstrated a trend towards an improvement of some parameters. Namely, waist circumference, 6MWT, 30'' Chair Stand test showed significant improvements and the assessment of body composition suggested physical exercise may exert a potential protective effect to sarcopenic obesity.

CONCLUSIONS

The physical exercise should be considered as effective as a drug for many diseases. In cancer survivors it reduces body fat, muscle fatigue, sedentary behaviors and depression, that all put a strain on the success of both pharmacological and surgical therapy. The exercise should be practiced regularly. Gym can ensure better implementation of the act but at the same time does not guarantee the proper conduct, therefore it becomes necessary to include physical activity as an integral part of the lifestyle.

Home based exercise may be a strategy for this purpose, insomuch as it is practiced individually and managed with periodic checks to ensure effectiveness and execution safety.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study.

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