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Muscle Strength and Quality of Life of Women with Breast Cancer Participating in a Combined Training Program

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Abstract

INTRODUCTION: *Physical exercise improves the mental health, well-being, physical capacity, functionality and quality of life of cancer patients.* ***OBJECTIVE:*** *Assess muscle strength and quality of life (QoL) in women with breast cancer, before and*

after undergoing a 6-week combined training program (CTP). ***METHODS:*** *The study consisted of women with primary breast cancer: an experimental group of 27 participants from the CTP and 16 control subjects, assessed for body weight (BW) height, circumferences, cutaneous folds, body mass index (BMI), waist-to-hip ratio (WHR) and body fat percentage (BFP).* ***RESULTS:*** *Mean age of the EG ($\bar{X}$= 54.15 ± 6.76 years) and CG ($\bar{X}$ = 52.44 ± 6.81 years) was similar, as were BMI ($\bar{X}$ = 26.26 ± 3.47; ($\bar{X}$ = 27.54 ± 4.57) and BFP ($\bar{X}$= 30.13 ± 6.03; ($\bar{X}$ = 29.21 ± 6.72). Post-test EG muscle strength increased in all the variables for UL (Δ% = 45.34; p=0.000), LL (Δ% = 50.95; p=0.000), and trunk movements (Δ% = 41.99; p=0.000) and StrInd (Δ% = 45.89; p=0.000); Post-test quality of life in the EG showed a statistically significant improvement (p<0.05) ($\bar{X}$ = 93.04 ± 9.10; Δ%: 24.73).* ***CONCLUSION:*** *A six-week CTP intervention was effective in improving the muscle strength and quality of life of women with breast cancer.*

Keywords: Oncology, Breast Cancer, Physical Exercise, Quality of Life Indicators

INTRODUCTION

It is undeniable that loss of muscle strength (MS) in patients with breast cancer (BC) during adjuvant treatment affects their activities of daily living and quality of life [1]. Women with breast cancer typically exhibit highly compromised muscle strength before and after anticancer treatment. Decreased muscle strength and sarcopenia have been associated with low performance, greater risk of death and more severe side effects in oncological patients. In order to prevent the aforementioned effects, implementing a systematic strength training routine during cancer (CA) treatment may attenuate the loss of muscle strength (MS) and its consequences [2].

Short, middle and long-term side effects are common and prevalent in patients after breast cancer or during treatment. These include weight loss, reduced MS, lymphedema, upper limb impairment, less mobility, low satisfaction and disposition, thereby compromising their quality of life. However, these effects may be attenuated by physical exercises, with combined resistance and aerobic training [3].

Physical exercise stimulates muscle growth, and strength training for muscle tension, muscle damage and metabolic stress participates actively in protein synthesis and induced muscle hypertrophy [4]. Effective maximal strength training, with an emphasis on velocity in the concentric phase, improves maximal strength and the characteristics of MS development [1], and is effective when moderate-to-vigorous intensities are applied using six to twelve repetitions maximum (RM), or six to twelve repetitions with 60 to 70% 1RM, especially in the post-treatment phase, lasting between six and 24 weeks [5].

Physical training is relevant during adjuvant CA treatment, because patients who engage in supervised physical exercise after diagnosis exhibit fewer side effects from conventional treatments (chemotherapy, radiotherapy and others) and lower recurrence and risk of death than their sedentary counterparts [6].

The effects of a combined program of strength and high-intensity aerobic exercises (80% of heart rate reserve) may be effective in improving quality of life,

maximal oxygen uptake and strength, in addition to reducing fatigue and plasma IGF-1 levels in breast cancer (BC) survivors. This protein is used as a biomarker for the risk of recurrent BC, and neither causes nor exacerbates lymphedema. Strength training may improve application of maximal force on the affected side of muscle groups in the shoulder and elbow of women submitted to mastectomy [7].

In order to ensure a positive effect in a combined aerobic and strength training program in BC survivors, it is important that an early structured physical exercise program be implemented in the rehabilitation protocol [8], with physical exercise considered a beneficial non-pharmacological alternative for improving physiological, metabolic and anti-inflammatory functions. In addition, it may improve fitness levels and quality of life and increase the survival of women with breast cancer [9].

The current epidemiological severity of breast cancer in Brazil and worldwide, and the fact that these malignant tumors are the most common among women [10], raises the following question: could a six-week periodized program of combined training (aerobic + resistance) increase muscle strength and improve the quality of life of women during radiotherapy treatment for breast cancer?

MATERIALS AND METHODS

The sample consisted of women volunteers diagnosed with breast cancer undergoing radiotherapy treatment, selected according to the inclusion and exclusion criteria. After being screened for inclusion and exclusion criteria, participants were randomly separated using http://randomization.com/ into two groups: 27 experimental group (EG) patients in a combined training program (aerobic + resistance) (54.15 ±6.76 years); 16 control group (CG) patients in a lecture and roundtable discussion program (52.44± 6.81 years).

The study was approved by the Tirandentes University Human Research Ethics Committee, under protocol no. 4.264.002 — CAE: 23682219.0.0000.5371.

Trained professionals performed diagnoses to ensure reliability of the findings. Dependent variables and the following independent variables were assessed: body weight (BW), height (H), circumferences, skinfolds, body mass index (BMI), waist-to-hip ratio (WHR) and body fat percentage (BFP). In order to evaluate static force, a Model 32527PP 400-Pound Push/Pull Dynamometer (USA) was used, according to the Johnson and Nelson protocol (1979), to analyze upper limb (bicep curls); trunk (anterior trunk flexion) and lower limb movements (knee extension) [11]. Quality of life was analyzed using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire "Core" 30 (EORTC-QLQ-C30) version 3.0 in Portuguese, in the form of an interview [12].

The experimental group underwent a six-week combined training program (aerobic + resistance) consisting of stretching, cardiorespiratory and strength exercises, three times a week in 40-to-50-minute sessions, divided as follows: 5 minutes stretching; 15-20 minutes cardiorespiratory resistance; 15-20 minutes strength and 5 minutes relaxation. The exercises were performed in **varied positions**: standing, sitting on a chair, a bench, on the floor and on hands and knees; **varied supports**:

unsupported, wall, chair back, wall mounted, stick and ball support; and **varied materials**: hands free, elastic band, dumbbell, stick and ball.

The program was prescribed in line with the adequate load to control effort intensity, maintained on a light-to-moderate scale between 50 and 75% of maximal heart rate, with a variation in the perceived exertion scale from 9 to 13 [13] [14] and with 3 to 6 metabolic equivalents of task (MET) [15] [16] [17] [18].

Control group patients were monitored at weekly roundtable discussions with participative leisure activities and multidisciplinary follow-up for six weeks.

Measures of central tendency and dispersion were used in data description. The mean (x) was calculated to represent the center of the dataset. Measures of dispersion estimate data variability. Standard deviation, minimum and maximum values and percentage variations (Δ%) were calculated [19] [20] [21].

The Shapiro-Wilk test was applied to determine data causality. The Bonferroni correction was used when the quantitative variables did not exhibit normal distribution. Data sphericity was determined by Bartlett's test. For the ordinal variable (QoL), the Wilcoxon and Mann-Whitney tests were used for intragroup and intergroup comparisons, respectively [20] [21] [22] [23].

RESULTS

With respect to sample characterization, the experimental and control groups were similar in mean (M) age (54 and 52 years, respectively); with maximum age of 62 years in the EG and 60 in the CG, and minimum of 40 years in both groups. In regard to weight, BMI and BFP, the mean value was similar for both groups, except WHR, which exhibited an intergroup difference (EG - M: 0.81; CG - M: 0.84).

Table 1 — Characteristics of women with breast cancer: mean and standard deviation of age, BW, BMI, WHR and BFP, Aracaju (2020).

		N	Mean	Standard Deviation	Minimum	Maximum	P-value (SW)
Age	EG	27	54.15	6.76	40.00	62.00	0.001
	CG	16	52.44	6.81	40.00	60.00	0.052
Weight	EG	27	67.41	9.22	48.00	88.00	0.370
	CG	16	68.94	9.91	53.50	89.00	0.431
BMI	EG	27	26.26	3.47	20.60	33.90	0.368
	CG	16	27.54	4.57	20.80	38.50	0.359
WHR	EG	27	0.81	0.06	0.73	0.96	0.232
	CG	16	0.84	0.07	0.73	1.00	0.455
BFP	EG	27	30.13	6.03	18.00	41.30	0.337
	CG	16	29.21	6.72	19.90	40.30	0.272

Legend: SW: Shapiro-Wilk; BMI: Body mass index; WHR: Waist/hip ratio; BFP: Body fat percentage; EG: experimental group; CG: control group.

The results of variable static muscle strength for upper limb (bicep curls), trunk (anterior trunk flexion) and lower limb (knee extension) movements and strength index before and after intervention, with mean and standard deviation values for the experimental and control groups are presented in Table 2. A significant increase (M) was observed in the EG for UL, LL, trunk movements and StrInd, with the control group showing no difference between these variables, and a post-test increase in delta % (UL Δ%:45.34); (LL Δ%:50.95); (trunk Δ%: 41.99); (StrInd Δ%: 45.89) for the experimental group.

Table 2 — Mean and standard deviation, effect size, and delta % of the upper limbs, lower limbs, trunk and strength index, Aracaju (2020).

Variable	Group	Mean (M)	Standard Deviation (SD)	Effect Size (d)	Delta % (Δ%)
UL - Pre-test	EG	18.30	12.10		
	CG	21.81	14.83		
UL - Post-test	EG	26.59	13.74	**0.69**	**45.34**
	CG	21.81	15.26	0.00	0.00
LL - Pre-test	EG	15.70	12.62		
	CG	21.09	15.17		
LL - Post-test	EG	23.70	13.84	**0.63**	**50.94**
	CG	21.19	15.15	0.01	0.47
Trunk - Pre-test	EG	15.26	11.99		
	CG	22.50	12.38		
Trunk – Post-test	EG	21.67	13.37	**0.53**	**41.99**
	CG	21.50	11.74	-0.08	-4.44
StrInd - Pre-test	EG	16.44	10.99		
	CG	21.84	12.40		
StrInd - Post-test	EG	23.99	12.55	**0.69**	**45.89**
	CG	21.51	12.22	-0.03	-1.52

Legend: UL: upper limbs; LL: lower limbs; StrInd: strength index.

The quality of life of women with breast cancer submitted to combined training (aerobic + resistance) showed a significant improvement ($p<0.05$) in the mean (M), standard deviation (SD) and delta %(Δ%) (M: 93.04; SD: 9.10; Δ%: 24.73) for the post-test quality of life of the experimental group**.**

Table 3 — Mean and standard deviation, effect size, and delta % to determine the quality of life of women with breast cancer, Aracaju (2020).

Variable	Group	Mean (M)	Standard Deviation (SD)	Effect Size (d)	Delta % (Δ%)
QoL- Pre-test	EG	74.59	19.12		
	CG	75.50	20.98		
QoL- Post-test	EG	93.04	9.10	**0.96**	**24.73**
	CG	63.25	21.06	-0.58	-16.23

Legend: QoL — quality of life.

DISCUSSION

A systematic review showed the independent effects of resistance training (RT) programs in reducing or reversing the adverse effects of cancer treatment [24]. In stress assessment, RT raised muscle strength and thoracic pressure scores. Lower body strength improved significantly, as observed in the present combined training program, which improved post-test static muscle strength in all the UL, LL, trunk movements and StrInd of the EG.

Another study conducted in 2016 [8] assessed the effects of a combined aerobic and strength program on the physiological and psychological parameters of breast cancer survivors. After 24 weeks, the intervention showed a significant improvement in VO_2max (38.8%), upper and lower limb strength (varying from 13 to 60%) and a decline in body fat percentage (−6.3%). This corroborates the findings of the present study that muscle strength improves in women undergoing cancer treatment, highlighting the importance of early supervised physical exercise in the rehabilitation protocols of oncological patients.

Similarly, another randomized clinical trial [25] investigated the effects of highly supervised resistance training (RT), once a week for eight weeks, on changes in

body composition and muscle strength in women with breast cancer, where 25 patients undergoing hormone therapy were randomized into a resistance training (TG, n = 12) or control group (CG, n = 13). It was found that one weekly highly supervised RT session produced good adherence and promoted muscle strength gains in women with breast cancer. This resembles the findings of the present study, in which muscle strength improved significantly in all the measures when compared to the group that did not participate in the 6-week training period.

In regard to quality of life, a constant and important variable in several oncological clinical trials, a cohort study conducted in 2018 examined the longitudinal impact of physical exercise components in the evolution of fatigue and quality of life, during and after adjuvant treatment for breast cancer in 424 patients, and found that fatigue increased and quality of life declined over the course of treatment. The inverse was observed after treatment, while during treatment the increase in fatigue and decrease in QoL were mitigated by regular physical activity (β = -8.71 for total fatigue; β = 14.59 for emotional function), but the results were less significant after treatment. The authors concluded that physical activity, especially its frequency, is an important determinant of fatigue, and that QoL during adjuvant treatment for breast cancer at least three times a week decreases fatigue and enhances QoL in women undergoing treatment [26]. The present study revealed that a combined aerobic + resistance training program for women with breast cancer, performed three times a week, has a positive impact on quality of life, underscoring the importance of implementing exercises before oncological treatment.

CONCLUSION

This study demonstrated that a six-week intervention consisting of a combined aerobic + resistance training program was effective in improving muscle strength, decreasing oncological fatigue and enhancing the quality of life of women with breast cancer.

It is important to carry out further studies on the association between physical training types, duration and methods for patients with breast cancer. It should be noted that given the significant strength gains and improved quality of life, physical exercises should be prescribed for oncological patients during diagnosis at Physical Activity Clinical Centers.

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