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RESISTANCE TRAINING, FATIGUE, QUALITY OF LIFE, ANXIETY IN BREAST CANCER SURVIVORS

--Manuscript Draft--

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Article Type: Original Research

Keywords: strength training; Health; Physical activity; exercise

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Abstract:

Resistance training (RT) has shown to be effective in improving fatigue, quality of life (QOL) and anxiety levels among breast cancer survivors (BCS), but there is no consensus as to how this practice should be prescribed for optimal performance. This study analyses the effects of once weekly RT on fatigue, QOL and anxiety levels among BCS. Randomized controlled trial. Twenty-five BCS (aged 54.6 ± 5.5 years) were randomized into resistance training or control groups. The resistance training group performed 8 weeks of resistance training (once per week). Fatigue was assessed using the Piper Fatigue scale, QOL was assessed using the SF-36 and anxiety was assessed using the STAI State-Trait Anxiety Inventory. Resistance training significantly improved the following subscales of SF-36: aspects of physical functioning (+27%, p= 0.027); physical role functioning (+54%, p= 0.008); emotional role functioning (+42%, p= 0.027); mental health (+16%, p= 0.032). Furthermore, resistance training improved fatigue levels (-55%, p= 0.001 for general fatigue) and anxiety (anxiety state, -19%, p= 0.012; anxiety trait, -23%, p= 0.001). Resistance training seemed to be a positive non-pharmacological tool for the reduction of fatigue, anxiety.
Response to Reviewers:

Dear Editor of the JSCR,

Thank you for the opportunity of resubmitting the revised version of the manuscript. We are sending a point-by-point answer to the reviewer’s comments, and the changes on the text were made by using the track change mode in MS Word. We hope the responses were adequate and clear. Please let us know if you need any additional information.

Reviewer#1: Review
Major comments
Hi,
The muscle and performance outcomes need to be clearly referenced and summarized in this paper - I cannot find the SANTOS et al 2019 reference in the original submission except a review from 2017 (did I miss it somehow?). As such, prior to publishing in JSCR, I recommend that the authors clearly state that this study was a multi-center study (methods) and reference/summarize muscle & performance outcomes (intro and discussion). It is my recommendation to not accept the paper until this is done.

So please provide evidence of the following and summarize in the paper:
"The current study is part of a multicentric research, and the strength and body composition data have been recently published (The TG improved muscle strength in 10 RM leg press (45°; Δ 33.75 ± 11.51 kg, P = .02; ES = 0.96) and bench press (Δ 4.08 ± 1.83 kg, P = .01; ES = 1.15). Adherence to training was more than 99%. Changes in body composition were not detected, SANTOS et al 2019)."

Response: Thank you for these comments. Santos et al. (2019) reference was inserted. Sorry for that mistake. It was informed in the Subjects section that the data from the present study are part of a multicenter study, and strength and body composition data were published elsewhere (SANTOS et al 2019). Additionally, strength and body composition data were also referenced and summarized in introduction and discussion section.

Reviewer#2: Review
Major comments
Please indicate in your response to reviewers the page and line number(s) that reflect where changes were made to address reviewer comments. For example, the very last comment made by reviewer 2 you indicate the changes were made. However, I was unable to find within the text where it was addressed. It would also be helpful to provide either a table that highlights the findings from this study already published regarding strength gains and also showing these findings so readers know this study resulted in more published findings. Or at least a brief overview instead of just referencing the study to support the introduction and again in the discussion. The way you have it in the discussion makes it sound like it was a different study altogether and that your study followed the same RT protocol but with a different population. If this is an extension of unpublished findings from the same study that needs to be more clear. Otherwise readers will want to know why you didn't measure strength gains when doing a RT intervention like reviewer 1 mentioned.

Response: The reviewer is right. The previous and current changes on the text were highlighted by using the track change mode in MS Word. Thus, we hope that the reviewer can find the changes. Moreover, it was informed in the Subjects section that the data from the present study are part of a multicenter study, and strength and body composition data were published elsewhere (SANTOS et al 2019). Due to copyright, we opt to not show a table with the previous published data. However, strength and body composition data were referenced and summarized in introduction and discussion section.
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RESISTANCE TRAINING, FATIGUE, QUALITY OF LIFE, ANXIETY IN BREAST CANCER SURVIVORS

Running head: Resistance training and breast cancer survivors

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RESISTANCE TRAINING, FATIGUE, QUALITY OF LIFE, ANXIETY IN BREAST CANCER SURVIVORS

Abstract
Resistance training (RT) has shown to be effective in improving fatigue, quality of life (QOL) and anxiety levels among breast cancer survivors (BCS), but there is no consensus as to how this practice should be prescribed for optimal performance. This study analyses the effects of once weekly RT on fatigue, QOL and anxiety levels among BCS. Randomized controlled trial. Twenty-five BCS (aged 54.6 ± 5.5 years) were randomized into resistance training or control groups. The resistance training group performed 8 weeks of resistance training (once per week). Fatigue was assessed using the Piper Fatigue scale, QOL was assessed using the SF-36 and anxiety was assessed using the STAI State-Trait Anxiety Inventory. Resistance training significantly improved the following subscales of SF-36: aspects of physical functioning (+27%, p=0.027); physical role functioning (+54%, p=0.008); emotional role functioning (+42%, p=0.027); mental health (+16%, p=0.032). Furthermore, resistance training improved fatigue levels (-55%, p=0.001 for general fatigue) and anxiety (anxiety state, -19%, p=0.012; anxiety trait, -23%, p=0.001). Resistance training seemed to be a positive non-pharmacological tool for the reduction of fatigue, anxiety, and for improvement of several aspects of quality of life in breast cancer survivors.

Keywords: strength training; health; physical activity; exercise
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INTRODUCTION

Among the more than 100 types of cancer, breast cancer is the most common cancer among women. Approximately 1.67 million cases of breast cancer occur annually around the world, accounting for about 25% of all cancer cases diagnosed in women. In Brazil, there are an estimated 59,700 new cases of breast cancer per year between 2018 and 2019, with an estimated risk of 56.38 cases per 100,000 women (1). Breast cancer is also the leading cause of cancer mortality in women worldwide, and an estimated 500,000 deaths from breast cancer occur globally (1).

Treatment is based on the healing of the disease associated with improvement of life expectancy and quality of life (QOL). Because the most common adverse effects in cancer patients are fatigue, pain, cognitive changes, mood disorders and decreased QOL (1,2), studies investigating strategies to improve these issues are needed. Regarding mood disorders, it has already been demonstrated that cancer treatment can induce psycho-emotional changes, with oscillations that can culminate in the development of mood disorders, especially anxiety and depression (3,4). Indeed, anxiety disorder among cancer patients is higher than among the general population, which can lead to a decrease in patient QOL and survival (3,4). These results can be partially explained by the fatigue and pain previously mentioned.

In terms of pain and fatigue, there are non-pharmacological approaches for reducing long-term and/or late side effects such as pain and fatigue. These effects can affect the functionality, psychological condition and QOL of patients. Among non-pharmacological approaches, regular physical exercise has been recommended as an important intervention to attenuate or extinguish adverse conditions related to treatment...
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and illness (5). Hanson et al. 2016 and Hagstron et al. 2015 investigated the effect of resistance training (RT) on fatigue and QOL of cancer patients and breast cancer survivors (BCS). Both studies found significant improvement for these two variables among women who did RT compared to those who did not exercise (6,7). In addition, it has already been demonstrated that regular physical exercise for women with cancer or BCS has beneficial effects in decreasing anxiety, particularly when performing aerobic exercises alone or combined with RT (8).

Studies have demonstrated the positive effects of RT on anxiety in middle-aged women (4,9). There is evidence that physical exercise is a promising intervention among non-pharmacological actions to manage fatigue, QOL and anxiety in patients with cancer or BCS. Recent findings have strongly suggested the prescription of RT only or combined with another activity such as running, walking or alternative practices for relaxation may help reduce these symptoms (10–12).

Although the number of studies involving exercise and breast cancer has been increasing in recent years, further studies are still required to improve information about RT in cancer patients. For example, recommendations about exercise prescriptions for breast cancer patients are based on RT guidelines for older people from the American College of Sports Medicine (4,13). However, it is reasonable to assume that RT for this population may present different physiological responses compared to other populations, possibly due to the adverse effects of treatment. In addition, less is known about the minimal dose of exercise to evoke positive adaptations among BCS. A recent study from our lab has showed that a low-volume resistance training program performed once a week increased the 10 maximum repetitions (RM) leg press strength...
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by 33.75 ± 11.51 kg (p= 0.02; d= 0.96) and the 10 RM bench press strength by 4.08 ± 1.83 kg (p= 0.01, d= 1.15) in BCS (14). Body composition (i.e., body fat, fat mass, and lean mass) was not altered (14). The strength gains were similar to other studies that used a high-volume (3 days per week in 16 weeks, three sets of eight to ten repetitions), and training frequency greater than twice a week (7,15). Changes in body composition were not detected (14).

However, studies evaluating the minimal dose of resistance training to evoke positive adaptations on levels of anxiety, fatigue and quality of life in breast cancer survivors in BCS are lacking. Thus, the objective of the present study was to investigate the effects of weekly low-volume RT on the fatigue, QOL and anxiety levels among BCS. We hypothesized that RT would improve the fatigue, QOL and anxiety levels among BCS.

METHODS

Experimental approach to the problem

In order to evaluate the effects of weekly low-volume RT on the fatigue, QOL and anxiety levels among BCS; the participants in the RTG performed RT once per week for 8 weeks, while the participants from the CNT remained physically inactive. Before and after the intervention, the participants answered questionnaires to assess fatigue, QOL and anxiety levels. Before beginning the training protocol, participants from RTG completed a familiarization session with RT exercises. All participants performed tests and re-tests of muscle strength assessment. The rest interval between the tests and retest was 3-5 days. Participants from the RTG were asked not to initiate any other exercise activity apart from the one included in this study. As the CNT did not
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follow an experimental protocol, for ethical reasons, control participants were offered the opportunity to participate in the RT programme, according to the participant’s interest, after the conclusion of the study.

Subjects

This was a randomized controlled trial study performed between January and December 2018. Twenty-six breast cancer survivors (BCS) were randomly allocated into resistance training (RTG) or control group (CNT) using the website www.randomization.org. The inclusion criteria were: women aged ≥ 40 years, postmenopausal, physically inactive (not involved in regular exercise in the last 6 months), have completed all cancer related therapies (i.e., surgery, radiotherapy and chemotherapy), receiving hormone therapy, being at least 6 months after treatment and having medical clearance to perform physical exercise. The exclusion criteria were: uncontrolled hypertension, diabetes diagnosis, cardiovascular diseases and/or any orthopaedic limitations. The participants were recruited from among BCSs treated at the Oncology Outpatient Clinic of the Federal University of Goiás, located in the city of Goiânia, Brazil. The recruitment was carried out over the telephone. Participants were informed of the study purpose and protocols, and all participants provided written informed consent before taking part in the study. The data from the present study are part of a multicenter study, and strength and body composition data were published elsewhere (14). All procedures were approved by the Local Ethics Committee - Research Ethics Committee of the Federal University of Goiás: 50717115.4.0000.5083 and Research Ethics Committee of the Clinical Hospital: 50717115.4.3001.5078. Informed consent (written) was obtained from all participants.

Fatigue assessment
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To evaluate the level of fatigue, the Fatigue Scale Questionnaire proposed by Piper et al. was used, in the translated and validated version. This questionnaire consists of 22 items subdivided into 4 dimensions: affective, sensorial, cognitive and behavioural. The total score was calculated by the mean of all questionnaire items and the scores of the separated dimensions were calculated by the average of the items contained in each dimension (16,17).

Quality of life assessment

To assess QOL the SF-36 (Medical Outcomes Study 36 - Item Short-Form Health Survey) was used, in the translated and validated version. The SF-36 is a widely used, generic questionnaire that consists of 8 subscales: functioning capacity (10 items), role limitations due to physical problems (4 items), pain (2 items), perception of general health (5 items), vitality (4 items), social functioning (2 items), role limitations due to emotional problems (3 items), and mental health (5 items). In addition, a single item provides an indication of perceived change in health (18,19). Subscale scores range from 0 to 100, with 100 being the best, most positive, QOL on the subscale measured and 0 the worst. Internal consistency of the SF-36 is good, with a Cronbach’s alpha ranging from 0.76 to 0.90 for all subscales of the questionnaire (18,19).

Anxiety assessment

The STAI State-Trait Anxiety Inventory, in the translated and validated version, was used to assess anxiety. It is composed of two distinct self-report scales to measure two distinct anxiety concepts: anxiety state (A-state) and anxiety trait (A-trait). The STAI anxiety score scale consists of 20 statements that require subjects to describe how they generally feel. The anxiety state scale also consists of 20 statements, and
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instructions for individuals indicate how they feel at a given time. For each statement, the subject must choose one of the four alternatives to indicate how he or she feels – on the A-state scale, these are: absolutely not, a little, enough, and very much, while on the A-trait scale these are almost never, sometimes, often and almost always (20–22).

Resistance Training Protocol

Before each session, a specific and supervised warm-up was performed, of one submaximal set before each exercise. The training sessions consisted of the following exercises: 45º leg press, stiff-legged dead lifts, bench press, lat pulldown and sit-ups. Participants were instructed to perform all sets until volitional failure, except for stiff-legged dead lifts and sit-ups. The load used in each exercise in the first training session was determined by the 10RM test for all exercises.

Before starting the exercise programme, one training session was held to familiarize participants with the training protocol. Training sessions included 3 sets, and subjects were instructed to perform all sets until volitional failure, and loads were adjusted during each set by the researcher to maintain the 8-12 RM, except for legged dead lifts, sit-ups and abdominal exercises. Both legged dead lifts and sit-ups exercises demand good technique for execution, thus, it was chosen for the accomplishment 8-12 repetitions with submaximal loads, and loads were adjusted across sets by the researcher to maintain the 8–12RM. The rest interval between sets and exercises was 2 min (23). It was performed 20 repetitions for the abdominal exercise, with a 1-min of rest interval between sets. The cadence was directed to control the eccentric phase of the movement for approximately two seconds and to perform rapid concentric muscular action for
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approximately one second. All exercises were oriented not to carry out the transition phase or pause between the cycles of movement.

Each volunteer had a training diary containing all of the information related to the exercises (repetitions per series and absolute weight per exercise), as well as a field to report possible intercurrences throughout the exercise programme. Training supervision was carried out by exercise and sports professionals and happened in a 1x1 (1 professional for 1 volunteer) form (24). All professionals were experienced with RT and with BCS.

Statistical analyses

Data were expressed as mean ± standard deviation. Normal data distribution was evaluated by using the Shapiro-Wilk test. Affective dimension of fatigue, anxiety trait and state, and pain and general health status of QOL data presented normal distribution. A two-way repeated- measures ANOVA (groups [RTG and CNT] x time [pre- and post-intervention]) was used to test for significant main effects and interactions for these data. In the case of significant differences, pairwise differences were examined by the Holm Sidaki’s post hoc test. The variables that did not present normal distribution were evaluated by using the Mann-Whitney test to compare RTG and CNT groups, while the Wilcoxon test was used for intra-group analysis. The level of significance was set at $p < 0.05$ and the software used for the statistical calculations was the Statistical Package for the Social Sciences (IBM SPSS)
RESULTS

There were 376 women identified as potential volunteers for the study, and 26 women were randomized to RTG group (n= 13) or CNT (n= 13). Exclusion occurred due to the difficulty of displacement to exercise facilities, not fitting the age group of the study and not receiving hormonal therapy, as well as the loss of a volunteer from the RTG group. Figure 1 shows the flowchart of participation and follow-up of the study. Table 1 summarizes the demographic data of the participants.

Regarding fatigue levels, there was no significant difference between groups in the pre- and post-intervention moments (p> 0.05). Significant changes were found in the scores regarding fatigue levels (Table 2) for the behavioural dimension (p= 0.001); sensory dimension (p= 0.008); cognitive dimension (p= 0.006) and for general fatigue (p= 0.001), so there was an overall decrease in fatigue values in the RTG group. For the CNT group, no significant changes were found in the values related to fatigue level: behavioural dimension (p= 0.59), sensory dimension (p= 0.47), cognitive dimension (p= 0.49) and for general fatigue (p= 0.3). In addition, there was no interaction (group x time, F= 3.27, p= 0.48) or group main effect (F= 0.003, p= 0.95) for affective dimension. However, a significant time main effect (F= 14.8, p< 0.001) was observed, in which post-intervention values were significantly greater than the baseline values (p< 0.001).

Concerning anxiety levels (Table 3), a group by time interaction was observed for both the anxiety trait (F= 8.19, p= 0.009) and the anxiety state (F= 4.39, p= 0.047). Anxiety levels decreased in the RTG group (p< 0.01), whereas for the control group, the
scores obtained did not indicate significant improvement in either Anxiety Trait (p = 0.91) or Anxiety State (p = 0.76).

QOL score changes are shown in the table 4. There was no group by time interaction (F = 0.51, p = 0.48), group (F = 2.9, p = 0.10) and time main effect (F = 0.10, p = 0.76) for general health status. There was also no group by time interaction (F = 1.23, p = 0.28), and group main effect (F = 0.10, p = 0.75) for pain. However, there was a time main effect (F = 12.11, p = 0.002), in which both groups improved pain score post-intervention moment (p = 0.002). In addition, there was no group or time main effect for vitality and social aspects (p > 0.05). In the comparison between RTG and CNT groups, at the post-intervention, there were significant differences in the results for only the physical limitations (p = 0.012) and emotional aspects (p = 0.018). Additionally, all other four aspects of quality of life there was a significant improvement in the RTG group: functional capacity (p = 0.027); physical limitations (p = 0.008); emotional aspects (p = 0.027) and mental health (p = 0.032). For the control group there was no significant improvement in QOL in any of the evaluated aspects: functional capacity (p = 0.27); limitations of physical aspects (p = 0.19); vitality (p = 0.84); social aspects (p = 0.62); emotional aspects (p = 1.0) and mental health (p = 0.83).

DISCUSSION

The aim of the study was to analyse the effects of weekly low-volume RT on fatigue, QOL and anxiety levels among BCS. The RT programme was performed with a high supervision rate (1:1) and low weekly frequency (one session per week). The results indicate that 8 sessions of RT with repetitions until voluntary failure, monitoring
training loads, contribute to a significant improvement on fatigue, anxiety levels, and a number of aspects of QOL among BCS.

It is important to highlight that fatigue conditions, QOL and anxiety are directly related to the prevention of relapses and better prognoses for survival of this population (25–27). Treatment strategies that improve these parameters are therefore desirable. In this context, a weekly low-volume RT may represent a substantial differential in the life of BCS, as well as being safe and efficient. Previous data of this multicentric study showed that the current resistance training protocol resulted in significant strength gains in BCS (14). Additionally, changes in body composition were not detected (14). Moreover, in a recent systematic review, Santos et al. (28) found that RT is safe for BCS and can improve different aspects, from the physical to the psychosocial. They also pointed out that an RT programme should consider the acute and chronic variables in their different approaches, and that additional studies should be carried out to better control and improve accuracy to provide optimal results.

Schmidt et al. (15) investigated the benefits of RT on fatigue and QOL in 101 middle-aged patients with breast cancer. The interventions were supervised and performed twice a week for 12 weeks with 3 sets of 8-12 reps with 60%-80% one maximal repetition (1-RM). Their results showed positive effects on fatigue and QOL. The evidences found by Hagstrom et al. (7) corroborated these results through evaluation of 39 women (average age: 51 years). Participants received supervised RT for 3 days per week over 16 weeks without controlling other variables. The results indicated a significant improvement in fatigue levels compared to the control group, along with significant and clinically important improvements in QOL. Our results are therefore in line with the literature, and we found similar outcomes to previous studies.
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for a RT programme performed only once a week. This result is important because it demonstrates that it is not necessary to have a high volume of RT to achieve a positive effect on fatigue, QOL and anxiety levels.

The studies of Cheema and Gaul, Hagstrom et al. and Benton, Schlairet and Gibson (7,29,30) have shown that RT is an important exercise for BCS. However, despite the significant results, there were weaknesses in the protocols of these studies, such as the lack of control of variables and lack of information related to the form of supervision and description of the exercises. We believe that controlling the variables related to RT, as done in our study (supervision, volume and intensity) may increase the magnitude of the effects of the activity for BCS.

Although there was no difference between RTG and CNT groups in the current study, the volunteers who underwent resistance training showed an improvement in anxiety levels, which are a new and important result for this population. Few studies have analysed the effect of RT on BCS anxiety levels. Saço et al. (8) evaluated anxiety levels in 50 women with breast cancer (control group and exercise group). The exercise modalities performed by the participants were not controlled or described. The study concluded that there was improvement in anxiety-trait levels (p= 0.0048) and state anxiety (p= 0.0359) in the exercise group. Similar evidence can be found in the study of Araújo et al. (9). Although the study was done with healthy, middle-aged women, the results are positive. The mean age of the women was 53 years and the RT occurred 3 times a week, with intensity of 40% of 1 RM and recovery interval of 1 min. They concluded that the RT programme reduced anxiety and promoted better mental health, verified by lower levels of depression and anxiety than in sedentary women.
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When comparing our results with other studies on RT and BCS, it is possible to perceive that the evidence points in the same direction – that is, interventions with RT promote positive effects for the health of this population. However, the studies present a great heterogeneity in the models and recommendations of resistance training for BCS, and there is no consensus as to how this practice should be prescribed for optimal performance. Most prior performed a greater number of weekly trainings with a longer duration – that is, over weeks and months (7,26,31–35); however, our results show that even with a low weekly training frequency, performing exercises until failure with close training supervision yields results that are as effective and significant as in the aforementioned studies, which have frequency of interventions of 2-3 times a week, duration of 12 weeks and intervention period of up to 12 months.

Other studies have associated training supervision with better results in the different analysed outcomes. Menezes et al. (36) found that supervised RT provides significantly better results compared to low or unsupervised practices among BCS. Results that align with this evidence can also be seen in the study by Gentil and Bottaro (24). It is also worth noting that several studies lack the control of training variables, which can be an influencing factor in the adaptive responses of the participants and, consequently, compromise the effects of RT for BCS.

The fact that the present study controls the intensity of RT may have been an influencing factor in obtaining results similar to those of studies with twice the frequency and duration of intervention, since these studies reported that the participants increased the load by 5%-10%, with intensity below 80% of 1MR, or simply did not
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control this variable (7,34,35). Adjusting training loads throughout the intervention
seems to play an important role in RT adaptations (37–39). Likewise, the control of
cadence in RT is important (39–42), as is the rest interval between sets (23). It is
therefore important that an exercise programme considers the manipulation of the acute
and chronic variables of the RT (43,44).

It appears that more careful planning of the supervision and control of RT
variables, such as intensity, rest interval and cadence, is the reason why the results
found in our study are as significant as the results of other studies with greater
frequency and longer intervention time (23,28). Important factors such as high
supervision, low training volume and sample homogeneity are points that deserve
attention, because the results suggest that they may have contributed directly to the
good results of the RT intervention for BCS. A significant limitation of the present
study is that the evaluation was made through questionnaires, which depend on
volunteer self-report.

In conclusion, a low-volume resistance training, performed once a week, with
high supervision and control of the exercise intensity, cadence and rest interval reduced
anxiety and several fatigue aspects, and improved a number of parameters related to
quality of life in breast cancer survivors. Based on the evidence presented, it appears
that once weekly resistance training should be recommended for this population.

PRACTICAL APPLICATIONS
The present results suggest that resistance training is a positive non-pharmacological tool for the reduction of fatigue, anxiety, improvement of the quality of life in breast cancer survivors. Additionally, strength and conditioning professionals, when designing resistance training, might consider a low-volume RT with a frequency of once week to improve levels of quality of life, anxiety and fatigue in breast cancer.

ACKNOWLEDGEMENTS

We thank all the participants and staff from all the centres participating in the study. The authors declare no conflicts of interest. The results of the present study do not constitute endorsement of the product by the authors or the NSCA.

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muscle size and strength from slow- movement, low-intensity resistance exercise


FIGURE LEGEND

Figure 1: Participant flow throughout trial.
Table 1. RTG and CNT group demographic data.

<table>
<thead>
<tr>
<th>Variables (mean ± SD)</th>
<th>RTG (n=12)</th>
<th>CNT (n=13)</th>
<th>Total (n=25)</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>55.0 ± 5.8</td>
<td>54.3 ± 5.2</td>
<td>54.6 ± 5.5</td>
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<td>Height (cm)</td>
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<td>156.0 ± 6.0</td>
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<td>Time from diagnosis (in months)</td>
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<td>Ethnicity (n and %)</td>
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<td>Brunette</td>
<td>2 (17)</td>
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</tr>
<tr>
<td>Yellow</td>
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<td>0 (0)</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Conjugal Situation (n and %)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>7 (58)</td>
<td>7 (54)</td>
<td>14 (56)</td>
</tr>
<tr>
<td>Divorced</td>
<td>2 (17)</td>
<td>4 (31)</td>
<td>6 (24)</td>
</tr>
<tr>
<td>Single</td>
<td>1 (8)</td>
<td>1 (7.5)</td>
<td>2 (8)</td>
</tr>
<tr>
<td>Widowed</td>
<td>2 (17)</td>
<td>1 (7.5)</td>
<td>3 (12)</td>
</tr>
<tr>
<td>Degree of education (n and %)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary School</td>
<td>7 (58)</td>
<td>6 (54)</td>
<td>13 (52)</td>
</tr>
<tr>
<td>High school</td>
<td>4 (33)</td>
<td>7 (46)</td>
<td>11 (44)</td>
</tr>
<tr>
<td>Higher education</td>
<td>1 (9)</td>
<td>0 (0)</td>
<td>1 (4)</td>
</tr>
</tbody>
</table>

CNT, control group; RTG, resistance training group; SD, standard deviation; n, absolute and relative number; BMI, body mass index;
Table 2. Changes in fatigue score.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Mean ± SD</th>
<th>Intragroup p-values</th>
<th>Between group p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre</td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Behavioural</td>
<td>CNT</td>
<td>3.3 ± 2.5</td>
<td>2.8 ± 2.5</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>5.1 ± 3.2</td>
<td>1.6 ± 1.1*</td>
<td>0.001</td>
</tr>
<tr>
<td>Affective</td>
<td>CNT</td>
<td>5.4 ± 3.5</td>
<td>3.4 ± 3.1*</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>6.0 ± 3.3</td>
<td>2.9 ± 2.7*</td>
<td>0.95</td>
</tr>
<tr>
<td>Sensory</td>
<td>CNT</td>
<td>3.8 ± 2.4</td>
<td>2.9 ± 2.2</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>4.6 ± 1.6</td>
<td>2.2 ± 2.0*</td>
<td>0.46</td>
</tr>
<tr>
<td>Cognitive</td>
<td>CNT</td>
<td>3.1 ± 1.5</td>
<td>2.9 ± 2.3</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>4.8 ± 2.5</td>
<td>2.5 ± 1.6*</td>
<td>0.006</td>
</tr>
<tr>
<td>General</td>
<td>CNT</td>
<td>3.9 ± 2.0</td>
<td>3 ± 2.4</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>5.1 ± 2.7</td>
<td>2.3 ± 1.4*</td>
<td>0.001</td>
</tr>
</tbody>
</table>

SD, standard deviation; CNT, control group; RTG, resistance training group; (*) p< 0.05, different from pre values.
Table 3. Changes in anxiety score.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Mean ± SD</th>
<th>P-values of group by time interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Anxiety state</td>
<td>CNT</td>
<td>40.2 ± 11.4</td>
<td>39.2 ± 13.9</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>47.3 ± 13.2</td>
<td>38.2 ± 10.9*</td>
</tr>
<tr>
<td>Anxiety trait</td>
<td>CNT</td>
<td>42.9 ± 11.2</td>
<td>42.6 ± 13.5</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>47.5 ± 11.8</td>
<td>36.6 ± 10.5*</td>
</tr>
</tbody>
</table>

SD, standard deviation; CNT, control group; RTG, resistance training group; (*) p< 0.05, different from pre values.
Table 4. Changes in quality of life.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Mean ± SD</th>
<th>Intragroup p-values</th>
<th>Between group p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre</td>
<td>Post</td>
<td></td>
</tr>
<tr>
<td>Functional capacity</td>
<td>CNT</td>
<td>54.0 ± 31.2</td>
<td>67.3 ± 18.9</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>59.6 ± 22.8</td>
<td>82.1 ± 24.6*</td>
<td>0.027</td>
</tr>
<tr>
<td></td>
<td>CNT</td>
<td>55.8 ± 41.0</td>
<td>38.4 ± 42.8</td>
<td>0.19</td>
</tr>
<tr>
<td>Physical limitations</td>
<td>RTG</td>
<td>37.5 ± 42.0</td>
<td>82.5 ± 31.2*#</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>CNT</td>
<td>46.0 ± 25.3</td>
<td>58.8 ± 31.9*</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>42.8 ± 20.3</td>
<td>67.5 ± 20.3*</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>CNT</td>
<td>56.0 ± 20.0</td>
<td>59.7 ± 24.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>53.3 ± 16.4</td>
<td>66.5 ± 17.9</td>
<td></td>
</tr>
<tr>
<td>General health</td>
<td>CNT</td>
<td>58.8 ± 19.2</td>
<td>59.2 ± 22.9</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>60.0 ± 23.6</td>
<td>69.3 ± 20.7</td>
<td>0.42</td>
</tr>
<tr>
<td>Vitality</td>
<td>CNT</td>
<td>73.8 ± 28.3</td>
<td>71.9 ± 32.3</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>68.8 ± 27.0</td>
<td>81.4 ± 22.4</td>
<td>0.13</td>
</tr>
<tr>
<td>Social aspects</td>
<td>CNT</td>
<td>56.3 ± 45.9</td>
<td>53.7 ± 44.2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>53.1 ± 43.7</td>
<td>91.6 ± 20.9*#</td>
<td>0.027</td>
</tr>
<tr>
<td>Emotional aspects</td>
<td>CNT</td>
<td>67.4 ± 20.3</td>
<td>68.9 ± 22.5</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>RTG</td>
<td>61.8 ± 21.8</td>
<td>73.7 ± 21.8*</td>
<td>0.032</td>
</tr>
</tbody>
</table>

SD, standard deviation; CNT, control group; RTG, resistance training group; (*) p< 0.05, different from pre values. (#) p< 0.05, different from CNT group.
Figure 1 (1).tiff