Physical Activity and Functional Capacity of Breast Cancer Patients: Prospective Cohort Study

Atividade Física e Capacidade Funcional de Pacientes com Câncer de Mama: Estudo de Coorte Prospectivo

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ABSTRACT

Introduction: Women with breast cancer may experience a decrease in physical fitness, fatigue, and muscle weakness after oncological treatment. Objective: To analyze changes in the level of physical activity (PA) and functional capacity of patients since the diagnosis of breast cancer and after surgical treatment. Method: Prospective cohort study including women with indication of curative surgery for breast cancer. Patients were assessed at the beginning of the study and after breast cancer surgery. To assess self-reported PA, the IPAQ was used, and functional capacity was measured using three physical tests: a 30-second sit-to-stand test, a two-minute step test, and handgrip strength. The comparison of variables before and after surgical treatment was performed using the Wilcoxon test, and the effect size was evaluated using Cohen’s D. Results: A total of 655 women were included, with the majority in the age range ≤ 59 years old (62.9%), 49.6% with advanced clinical stage ≥ IIB, and 48.9% undergoing surgery as their first oncological treatment. After surgical treatment, there was a reduction in the level of total PA, walking, and moderate intensity PA (p < 0.001 and Cohen’s D = 0.31; 0.50; 0.15, respectively), as well as handgrip strength (p < 0.001; Cohen’s D = 0.38). An increase in aerobic capacity and lower limb resistance performance was observed (p < 0.001 in both tests, Cohen’s D = 0.23 and 0.39, respectively). Conclusion: Breast cancer patients showed an increase in aerobic capacity and lower limb resistance. However, they experienced a reduction in handgrip strength and a significant decrease in PA levels, particularly in walking, with a substantial impact on their physical well-being.

Key words: Breast Neoplasms/surgery; Functional Status; Physical Fitness; Exercice Test.

INTRODUCTION

Breast cancer patients may experience a decrease in physical fitness, fatigue, and muscle weakness after oncological treatment. The aim of this study was to analyze changes in the level of physical activity (PA) and functional capacity of patients since the diagnosis of breast cancer and after surgical treatment. The study included women with indication of curative surgery for breast cancer. Patients were assessed at the beginning of the study and after breast cancer surgery. To assess self-reported PA, the International Physical Activity Questionnaire (IPAQ) was used, and functional capacity was measured using three physical tests: a 30-second sit-to-stand test, a two-minute step test, and handgrip strength. The comparison of variables before and after surgical treatment was performed using the Wilcoxon test, and the effect size was evaluated using Cohen’s D.

RESULTS

A total of 655 women were included, with the majority in the age range ≤ 59 years old (62.9%), 49.6% with advanced clinical stage ≥ IIB, and 48.9% undergoing surgery as their first oncological treatment. After surgical treatment, there was a reduction in the level of total PA, walking, and moderate intensity PA (p < 0.001 and Cohen’s D = 0.31; 0.50; 0.15, respectively), as well as handgrip strength (p < 0.001; Cohen’s D = 0.38). An increase in aerobic capacity and lower limb resistance performance was observed (p < 0.001 in both tests, Cohen’s D = 0.23 and 0.39, respectively).

CONCLUSION

Breast cancer patients showed an increase in aerobic capacity and lower limb resistance. However, they experienced a reduction in handgrip strength and a significant decrease in PA levels, particularly in walking, with a substantial impact on their physical well-being.

Key words: Breast Neoplasms/surgery; Functional Status; Physical Fitness; Exercice Test.
INTRODUCTION

Breast cancer is the most incident malignant neoplasm in women, except non-melanoma skin cancer in all the Brazilian regions and worldwide. The estimates of the Global Cancer Observatory (Globocan) produced by the International Agency for Research on Cancer (IARC), indicated 2.3 million new cases of breast cancer in the whole world in 2022. For each year of the triennium 2023-2025, 73,610 thousand new breast cancer cases are estimated in Brazil.

In 2022, 665,684 women died of breast cancer, the main cause of death in the female population. Mortality is directly associated with the diagnosis of tumor staging and type of treatment offered.

Breast cancer treatment is divided in two modalities, local, consisting in surgery and radiotherapy and systemic, as chemotherapy, hormone therapy and biological therapy. Due to the aggressiveness of the disease and treatment, adverse effects such as cardiac dysfunction, weight loss, bone loss, lymphedema, arthralgia, fatigue, cognitive dysfunction may occur, in addition to breast cancer relapse or metastasis. These conditions may compromise women's quality-of-life for a long period or lifelong, which directly affects their activities of daily and professional life.

According to the World Health Organization (WHO), physical activity (PA) is defined as any bodily movement produced by skeletal muscles that requires more energy expenditure than at rest. It recommends at least 150 to 300 minutes of moderate aerobic activity per week or 75 to 150 minutes of intense aerobic activity for 18-64 years adults. According to the Instituto Brasileiro de Geografia e Estatística (IBGE), 40.3% of the Brazilian adult population are classified as insufficiently active and 47.5% of the female population, insufficiently active, as high level, sufficiently active but insufficiently active, as low, moderate and high PA according to the practice guidelines of International Physical Activity Questionnaire (IPAQ), the participants who exceeded 960 min/week of PA were excluded from the analysis.

Individuals classified by IPAQ as low PA are insufficiently active, as high level, sufficiently active but insufficiently active according to WHO.
and blood pressure through digital sphygmomanometer. Oxygen saturation and heart rate were checked with wrist oximeter\textsuperscript{16,17}. These parameters allowed to contraindicate the tests and avoided exposing the patients to potential complications.

The handgrip strength, also utilized as global health parameter was measured with digital dynamometer Smedley Takei III (Yagami Co Ltd., Tokyo, Japan). The patient was guided to exert handgrip strength three times, registered in kilogram-force (kgf), and the mean of the three values was utilized in the analysis\textsuperscript{18}.

The 30 second sit-to-stand test evaluates the resistance of lower limbs, the patients were guided to sit and stand from a regular chair with the arms crossed at shoulder height. The participants repeated the test as much as possible to the command of the reviewer for 30 seconds and the total number of repetitions was logged\textsuperscript{19}.

Sociodemographics (age, race/skin color, marital status, work relationship at the diagnosis, family income, alcohol use in the last 30 days, current tobacco use) and clinic (arterial hypertension, diabetes, body mass index, menopausal status, clinical condition and first treatment performed) were collected additionally from physical and electronic charts and enrollment interview to characterize the study population.

Measures of central tendency, dispersion and frequency described the sociodemographic and clinical characteristics of the population. The normality distribution test of Kolmogorov-Smirnov examined if variables are normally distributed. The non-parametric tests were presented as median and minimum and maximum range. The Wilcoxon test compared these variables and Cohen’s D test to evaluate the effect size. According to Cohen\textsuperscript{19}, an effect size $D = 0.10$ to 0.29 is small, $D = 0.30$ to 0.49, medium and $D = 0.50$ to 1.0, large. Values of $p < 0.05$ were statistically significant. The Statistical Package for Social Sciences (SPSS)\textsuperscript{20} version 21.0 was utilized for the study’s analyzes.

RESULTS

The original study evaluated 1,075 women, 119 of which were not eligible, totaling 956 patients, but 301 participants were excluded for missing data of self-reported PA or more than 960 min/week self-reported PA, reaching a final sample of 655 patients. The number of participants of each test was different due to contraindications, for instance, arterial hypertension, drop of peripheral oxygen saturation, pain or some type of physical or emotional problem when the test was performed which impeded the application of the questionnaires and physical evaluation (Figure 1).

The majority of the study population were aged ≥ 59 years (62.9%), 64.0% claimed they were non-White, 50.5% were not living with spouse when they were interviewed, 56.3% had more than eight years of education and 57.4% had no work relationship. 74.0% did not use alcohol in the last 30 days and 92.7% claimed they did not smoke or quit smoking (Table 1).

The clinical characteristics revealed that 47.6% had arterial hypertension, 17.9% had diabetes, 73.7% were overweight or obese, 65.0% were in menopause, 49.6% at advanced clinical staging ≥ IIB, and surgery was the first treatment performed (48.9%) (Table 2).

The evaluation of the level of PA before and one to four years after surgical treatment revealed a statistically significant reduction of total PA, walking and moderate PA ($p < 0.001$; Cohen’s $D = 0.31; 0.50; 0.15$, respectively), despite an increase of strong activities ($p < 0.001$; Cohen’s $D = 0.15$) and leisure ($p < 0.001$; Cohen’s $D = 0.15$) (Table 3).

The patients improved the aerobic fitness and endurance of lower limbs after surgery treatment according to the evaluation of functional capacity ($p < 0.001$ for both tests, Cohen’s $D = 0.23$ and 0.39, respectively), although the handgrip strength declined after surgery ($p < 0.001$; Cohen’s $D = 0.38$) (Table 3).

DISCUSSION

The objective of the study was to evaluate the levels of PA and functional capacity of women with breast cancer at the diagnosis and one to four years after surgical treatment. An increase of aerobic fitness and endurance of lower limbs, reduction of handgrip strength and level of PA of walking were noticed.
Mazo et al.\textsuperscript{21} applied the set of Senior Fitness Test\textsuperscript{16} to develop normative values for Brazilian healthy women in the age-range of 60-69 years who practiced PA for at least six months\textsuperscript{21}. This test classified the physical fitness of 60-69 aged women who repeated at least 12.5 times the sit-to-stand test as very good. Compared to the present study, despite most of the patients were aged 59 years or younger, they were able to keep the number of repetitions of sit-to-stand test similar to what was found (13 repetitions) for older women.

According to Rikli and Jones\textsuperscript{22}, due to physiological issues, physical fitness tends to decline from 60 years onward. The mean of 13.8 repetitions of the sit-to-stand test and mean of 85.9 steps per minute in the 2 minute in-place test was found for the healthy population aged 60-69 years. These data were similar to what was found in the present study, when women performed 13.0 repetitions and walked 90.8 steps, respectively, which suggests that this population, although younger, is as physically fit as an older population, a concerning scenario.

A prospective observational study performed by Grusdat et al.\textsuperscript{23} with 79 women with mean age of 54.6 years (±9.5) who had breast cancer, evaluated the handgrip strength in three time points: before, one week later and three months after breast cancer treatment. These patients were submitted to four types of treatment: surgery alone, surgery and chemotherapy and radiotherapy or surgery and radiotherapy. The means of handgrip strength were 31.9 kgf, 28.0 kgf and 27.8 kgf respectively, revealing post treatment reduction.

A Germany study with healthy women and age-range of 50-54 years presented mean of 32.5 kgf and identified that values below 26.6 kgf were considered at risk of reducing muscle function\textsuperscript{24}. The patients of the present study – median of 19.8 kgf (3.8-32.3) – revealed damaged muscle strength since diagnosis through post-surgery if compared with the two aforementioned studies.
The study of Ortiz et al.25 enrolled 89 breast cancer survivors from Texas and Puerto Rico, USA, with mean age of 55.5 years (±10.0), who submitted to treatment for at least three months and sedentary behavior (did not perform regular physical exercises). The mean of handgrip strength of these patients was 10.3 (±9.4) kgf, mean of 11.60 (±3.1) repetitions of the sit-to-stand test and low level of moderate and vigorous PA with mean of 76.5 (±183.5) metabolic equivalent of the task (MET) min/week by IPAQ.

A median of 19.8 kgf (3.8-32.3) of handgrip strength post-surgery for the present study was found and despite the decline of strength, it was even higher than the patients investigated by Ortiz et al.25. Furthermore, the number of repetitions of the sit-to-stand test was similar to the present study [13.0 (5.0-30.0) repetitions]. The patients analyzed presented reduction of the levels of moderate PA [at diagnosis: 1,695.0 (0.0-19,560.0) and post-surgery: 1,160.0 (30.0-16,037.0)], however, in this period, vigorous intensity PA improved [at diagnosis: 0.0 (0.0-25,200.0) and post-surgery: 960.0 (120.0-20,160.0)].

A cross-sectional study conducted by Zainordin et al.26 with 95 women who completed oncologic treatment for breast cancer were submitted to a 3-month protocol of exercises with 12 sessions of moderate to high intensity. The mean age of the population was 59.6 (±10.7); upon completion of the exercise program, it has been identified that the women increased the time dedicated to moderate to vigorous PA (172.8 vs. 344.6; p = 0.01), improvement of the performance of the sit-to-stand test [12.5 (±4.2) vs. 14.9 (±5.2); p = 0.01] and the distance covered in the 6 minute in-place test increased (427.8 vs. 469.9; p = 0.01)27.

The implementation of a program of physical exercise for women submitted to breast cancer treatment was positive and improved the PA and their functional capacity and can be encouraged in breast cancer treatment centers to prevent the decline in these domains.

The strength of the present study was the robust sample with 655 women investigated, indicating good power to when the two groups were evaluated together, a total mean MET of 403.5 (±332.7) min/week was found. Despite the author had evaluated a group with more than one type of cancer and the current study had evaluated only women with breast cancer, the results herein revealed higher PA level at diagnosis and from one to four years post-surgery when compared to these authors26.

The study of Tami-Maury et al.27 carried out in USA included 127 women who completed the first treatment for breast cancer, surgery, radiotherapy, chemotherapy or hormone therapy. These women were submitted to a 3-month protocol of exercises with 12 sessions of moderate to high intensity. The mean age of the population was 59.6 (±10.7); upon completion of the exercise program, it has been identified that the women increased the time dedicated to moderate to vigorous PA (172.8 vs. 344.6; p = 0.01), improvement of the performance of the sit-to-stand test [12.5 (±4.2) vs. 14.9 (±5.2); p = 0.01] and the distance covered in the 6 minute in-place test increased (427.8 vs. 469.9; p = 0.01)27.

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The strength of the present study was the robust sample with 655 women investigated, indicating good power to
analyze the results. The study team was trained for two weeks to apply the IPAQ, physical tests and approach to the patients with standard collecting forms to minimize potential information bias. The questions addressed current data or of the previous week, minimizing possible memory bias.

The main limitation was the clinical, physical or emotional contraindication to perform functional tests, resulting in different number of participants in each test but the sample size was satisfactory.

The questionnaire IPAQ evaluates PA across many dimensions as leisure, work, home activities and transportation. Despite its subjective evaluation nature, it is the most utilized to assess the dimensions of daily PA. Another possible study limitation were two evaluations in two specific time points because it is not possible to know whether the patients initiated, kept or discontinued the physical exercises between these two moments.

CONCLUSION

Women with breast cancer submitted to surgery treatment at HC III/INCA improved the levels of aerobic fitness and endurance of lower limbs, had reduced handgrip strength and great decline of levels of PA, specifically the walk test since diagnosis until one to four years post-surgery. These findings highlight the importance of comprehensive approaches for rehabilitation and physical support of these patients during and after breast cancer treatment to keep satisfactory quality-of-life.

CONTRIBUITIONS

Natasha Catalano Silva contributed to the acquisition, analysis and interpretation of the data and wording. Clarice Gomes Chagas Teodózio and Maurício San’Anna Junior contributed to the analysis and interpretation of the data and critical review. Suzana Sales de Aguiar, Luiz Claudio Santos Thuler and Anke Bergmann contributed to the study design, data analysis, wording and critical review. All the authors approved the final version to be published.

DECLARATION OF CONFLICT OF INTERESTS

The author Anke Bergmann, the scientific-editor of INCA’s Revista Brasileira de Cancerologia, declares potential conflict of interests. The other authors have no competing interests.

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REFERENCES


