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# Physical activity, functional ability, and quality of life after breast cancer surgery<sup>☆</sup>



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## KEYWORDS

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Exercise;  
Quality of life

**Summary** This cross-sectional study aimed to assess the influence of different surgical treatment modalities on the level of physical activity, functional capacity, and quality of life of breast cancer survivors. One hundred eighty women aged 30–60 years old were selected and allocated to control group (CG, women without breast cancer,  $n = 45$ ), breast-conserving surgery group (BCG,  $n = 45$ ), mastectomy group (MG,  $n = 45$ ), and breast reconstruction group (BRG,  $n = 45$ ). Physical activity, functional capacity, and quality of life were assessed, respectively, using the following self-report questionnaires validated for use in Brazil: International Physical Activity Questionnaire (IPAQ), Stanford Health Assessment Questionnaire (HAQ-20), and Medical Outcomes Study 36-item Short-Form Health Survey (SF-36). The groups were homogeneous relative to sociodemographic variables. The scores for physical activity (IPAQ) did not differ between CG and BRG, whereas they were better for CG than for BCG and MG ( $p = 0.0270$ ). The results for functional capacity (HAQ-20) were better for CG than for MG ( $p = 0.0450$ ), with no difference between the remaining groups. Differences were found for the SF-36 domains “physical functioning” ( $p < 0.01$ ), “physical role functioning” ( $p < 0.001$ ), “emotional role functioning” ( $p = 0.0174$ ), and “general health” ( $p = 0.0307$ ). CG and BRG differed significantly relative to the domains “physical role functioning” and “emotional role functioning” only. We concluded that patients who underwent breast reconstruction exhibited higher levels of physical activity and quality of life than patients subjected to mastectomy alone or breast-conserving surgery.

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## Introduction

Breast cancer is the most common type of cancer among women in developed and developing countries.<sup>1</sup> Advances in screening, diagnostic techniques, and treatment have increased the survival rate of affected women.<sup>2</sup> However, treatment poses countless challenges to survivors, such as

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psychological and physical complications including musculoskeletal disorders, premature menopause, cardiovascular problems, and fatigue, among others.<sup>3,4</sup>

The increase in survival rates have led to greater concern worldwide with regard to the quality of life of cancer survivors. There has been a consequent increase in posttreatment care programs, which include an assessment of not only signs of disease relapse but also lifestyle guidelines. Consequently, there has been a growing number of studies assessing the impact of cancer treatment on the quality of life of patients; these studies have proposed strategies to minimize this impact, such as physical activity, psychosocial education, return to work, or combined therapies.<sup>4-7</sup>

According to some studies, physical activity can improve physical capacity, minimize cancer treatment-related symptoms, and improve quality of life.<sup>8-10</sup> The guidelines for cancer survivors formulated by the American Cancer Society and National Comprehensive Cancer Network (NCCN) recommend moderate physical activity for at least 150 min per week. However, most patients do not comply with these recommendations for aerobic exercise, and thus, patients need to be made more aware of the benefits of physical activity.<sup>11-13</sup>

Within this context, the number of studies on the relationship between the effects of different types of surgical treatment for breast cancer and physical activity is still small. Therefore, the aim of the present study was to assess physical activity, functional capacity, and quality of life among women subjected to different surgical treatment modalities for breast cancer.

## Methods

The present cross-sectional study was started following approval from the institutional research ethics committee (approval #188717). All participants signed an informed consent form.

A total of 180 women aged 30-60 years old, with any education level and body mass index (BMI) between 18 and 30 kg/m<sup>2</sup>, were recruited at the Breast Care and Plastic Surgery outpatient clinics of a university hospital (Hospital São Paulo, Universidade Federal de São Paulo - UNIFESP). Forty-five were women without a history of breast cancer, and 135 had undergone surgical treatment for breast cancer at least one year earlier. Women presenting any of the following conditions were excluded: pregnancy or labor within the past year, other surgical procedure within the past year, disease relapse, metastasis, currently undergoing diagnostic investigation, and inability to read the applied instruments.

The included women were divided into four groups: control group (CG,  $n=45$ ), composed of women without a history of breast cancer; breast-conserving surgery group (BCG,  $n=45$ ), composed of women subjected to breast-conserving surgery without any reconstructive or oncoplastic procedure; mastectomy group (MG,  $n=45$ ), composed of women subjected to mastectomy without reconstruction; and breast reconstruction group (BRG,  $n=45$ ), composed of women subjected to immediate or delayed reconstruction by means of any technique.

Sociodemographic and clinical data were collected, and three self-reporting instruments validated for use in Brazil

were applied: International Physical Activity Questionnaire (IPAQ),<sup>13,14</sup> Health Assessment Questionnaire (HAQ-20),<sup>15,16</sup> and Medical Outcomes Study 36-item Short Form Health Survey (SF-36).<sup>17,18</sup>

IPAQ assesses physical activity performed during a typical week. It comprises four domains: leisure-time physical activity, job-related physical activity, housework, and transportation physical activity. For each domain, respondents should indicate how much time they spent in the corresponding activity and how many times the activity was performed in the past week. The volume of activity is computed in METs (metabolic equivalents), where 1 MET = 4184 kJ kg<sup>-1</sup> h<sup>-1</sup> (metabolic rate at rest).<sup>13</sup> The various intensities of physical activity are attributed a MET value as follows: mild (e.g., walking) 3.3 METs; moderate (e.g., cycling) 4.0 METs; and vigorous 8.0 METs. The total score is expressed as MET-minutes/week, which is calculated by multiplying the MET value of each activity (according to its intensity) by the weekly frequency and time spent performing it. The values obtained for each activity provide two sets of data: MET-min and frequency; on this basis, physical activity is classified as low, moderate, or high.<sup>13,14</sup>

The HAQ-20 is a specific instrument to measure functional capacity. It comprises 20 questions on activities of daily life, which are scored according to the respondents' ability to perform them, thus resulting in a single score ranging from 0 to 3; the lower the score is, the better is the functional capacity.<sup>15,16</sup>

The SF-36 is a generic instrument for the assessment of quality of life. Items are distributed across eight domains, which are analyzed separately; the scores range from 0 to 100, and the higher the score is, the better is the quality of life.<sup>17,18</sup>

## Statistical analysis

Measures of central tendency (median, mean, and standard deviation) were used to describe numerical variables, and absolute and relative frequencies were used for categorical variables.

Demographic and clinical data were compared between independent groups using the Kruskal-Wallis test for numerical variables, and the chi-square test was used for categorical variables. IPAQ scores were compared among the four groups using the chi-square test. The Kruskal-Wallis test was used to compare HAQ-20 and SF-36 domain scores. Whenever statistical significance was found, a multiple comparison testing was performed to establish which group significantly differed from the others.

The significance level was set to 0.05 (5%) in all analyses. Statistical analysis was performed with BioEstat 5.3 software (Mamirauá Institute of Sustainable Development, Belém, Pará, Brazil).

## Results

Table 1 describes the main demographic characteristics of the participants. The groups were homogeneous relative to all the analyzed characteristics. Table 2 describes the main

**Table 1** Sociodemographic characteristics of participants from the control, breast-conserving surgery, mastectomy, and breast reconstruction groups.

Variables	CG	BCG	MG	BRG	<i>p</i>
	<b>Median</b>				<b>Kruskal-Wallis</b>
Age (years)	47	50	50	52	0.5361
BMI (kg/m <sup>2</sup> )	25	25	25	25	0.8801
	<b><i>n</i> (%)</b>				<b>Chi-square</b>
Education level					0.3457
Primary	15 (33)	11 (24)	20 (44)	10 (22)	
Secondary	22 (49)	26 (58)	20 (44)	27 (60)	
Higher	8 (18)	8 (18)	5 (12)	8 (18)	
Menopause					0.2984
Yes	28 (62)	31 (69)	33 (73)	33 (76)	
No	17 (38)	14 (31)	12 (27)	9 (27)	
Smoking					0.8415
Yes	8 (18)	8 (18)	11 (24)	9 (20)	
No	37 (83)	37 (83)	34 (76)	36 (80)	

CG: control group; BCG: breast-conserving surgery group; MG: mastectomy group; BRG: breast reconstruction group.

**Table 2** Clinical characteristics of participants from the breast-conserving surgery, mastectomy, and breast reconstruction groups.

Variables	BCG	MG	BRG	<i>p</i>
	<b>Median</b>			<b>Kruskal-Wallis</b>
Time since surgery (months)	26	32	21	0.3258
	<b><i>n</i> (%)</b>			<b>Chi square</b>
Tumor site				0.3194
Left breast	23(51)	23 (51)	19 (42)	
Right breast	21(47)	22 (49)	22 (49)	
Bilateral	1(2)	0 (0)	4 (9)	
Axillary lymph node dissection				0.7270
Yes	39(67)	41 (73)	39 (67)	
No	6(33)	4 (27)	4 (22)	MG > BCG and BRG
Chemotherapy				0.3337
Yes	39 (75)	41 (95)	43 (96)	
No	6 (25)	4 (5)	2 (4)	BRG > MG and BCG
Radiotherapy				0.0026
Yes	45 (100)	37 (82)	34 (76)	
No	-	8 (18)	11 (24)	BCG > MG and BRG

BCG: breast-conserving surgery group; MG: mastectomy group; BRG: breast reconstruction group.

clinical characteristics of the three groups composed of patients with breast cancer. Once again, the groups did not show significant difference relative to the analyzed characteristics, except for radiotherapy, which was more frequent in the BCG, as all the patients from this group had been subjected to this adjuvant treatment.

Table 3 presents the comparison of IPAQ, HAQ-20, and SF-36 scores among CG, BCG, MG, and BRG. CG exhibited better scores for physical activity (IPAQ) than BCG, MG, and BRG. In turn, BRG exhibited better scores than MG but was similar to that of CG, without a significant difference. Figure 1 presents the intergroup comparison in MET values for all groups.

CG exhibited better results than MG for physical capacity (HAQ-20); no difference was found for the remaining groups. For quality of life (SF-36), the groups differed relative to the domains “physical functioning” (for which BCG exhibited the poorest results), “physical role functioning”

and “emotional role functioning” (all the groups composed of patients with cancer exhibited poorer results than CG), and “general health,” for which MG exhibited the poorest results (Table 3).

Table 4 presents the intergroup comparisons of the three physical activity categories according to IPAQ.

## Discussion

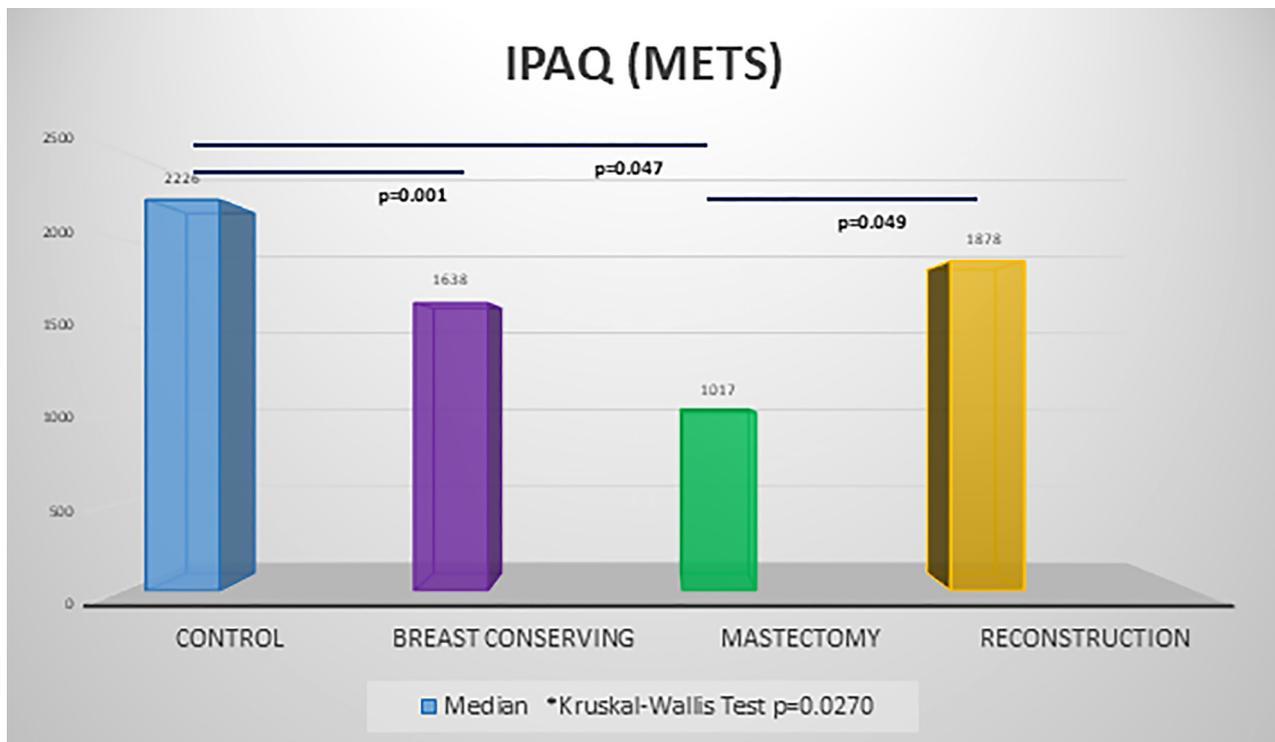
The present study was designed to investigate the influence of different surgical treatment modalities on the physical aspects of the quality of life of patients with breast cancer, particularly their functional capacity and physical activity levels. The results showed that as a rule, patients subjected to mastectomy exhibited the poorest results in all the analyzed aspects, more particularly lower physical activity, functional capacity, and general health; these differences

**Table 3** Median IPAQ (METS), HAQ-20, and SF-36 scores of the control, breast-conserving surgery, mastectomy, and breast reconstruction groups and intergroup comparisons.

	CG	BCG	MG	BRG	<i>p</i> value*
IPAQ (METS)	2167	1638	1017	1878	0.0270 CG > BCG and MG BRG > MG
HAQ-20	0.29	0.42	0.47	0.35	0.0450 CG > MG
SF-36					
PF	85	50	65	75	<0.0001 CG > MG > BCG
PRF	100	50	25	75	<0.0001 CG > BCG, MG, and BRG
PAIN	70	62	51	62	0.0589
GH	77	72	65	72	0.0307 CG, BCG and BRG > MG
VIT	70	65	55	65	0.1628
SRF	100	87	86	100	0.0506
ERF	100	66	66	67	0.0174 CG > BCG, MG, and BRG
MH	76	68	68	64	0.3896

CG: control group; BCG: breast-conserving surgery group; MG: mastectomy group; BRG: breast reconstruction group; PF: physical functioning; PRF: physical role functioning; PAIN: bodily pain; GH: general health; VIT: vitality; SRF: social role functioning; ERF: emotional role functioning; MH: mental health.

\* *P*-values based on the Kruskal-Wallis test. When significance was found, multiple comparison testing was performed.



**Figure 1** Median IPAQ MET values for all groups and comparison using the Kruskal-Wallis test ( $p = 0.0270$ ) followed by multiple comparison testing.

**Table 4** Level of physical activity in the control, breast-conserving surgery, mastectomy, and breast reconstruction groups according to the IPAQ.

	n (%)			
	CG	BCG	MG	BRG
<b>Low</b>	3 (7)	5 (11)	12 (27)	8 (9)
<b>Moderate</b>	28 (62)	33 (73)	29 (64)	26 (69)
<b>High</b>	14 (31)	7 (16)	4 (9)	11 (22)
<b>Total</b>	45 (100)	45 (100)	45 (100)	45 (100)

Chi-square test:  $p = 0.0306$ .

were statistically significant. The participants who underwent breast-conserving surgery exhibited the poorest scores for physical capacity (SF-36). In turn, the results for physical activity, physical capacity, or functional capacity of patients subjected to breast reconstruction did not show significant difference compared to those for patients without cancer.

The selection criteria applied sought to obtain homogeneous groups, the only difference being the type of surgical procedure to which the patients had been subjected. The upper BMI limit was set to 30 kg/m<sup>2</sup> because according to World Health Organization, values above this cutoff point characterize obesity, which could have affected the level of physical activity.<sup>19</sup> The results for physical activity measured in METs were lower for BCG and MG than for the participants without cancer. Other studies also found higher levels of inactivity and sedentary behavior among patients with breast cancer.<sup>5,20</sup> Along the same line, Phillips et al. and Ortiz et al. assessed physical activity levels using an accelerometer and found higher sedentary behavior among breast cancer survivors than among noncancer controls.<sup>10,21</sup>

In turn, the behavior of BRG relative to physical activity as measured by IPAQ was similar to that of CG. No difference was found between these two groups, while BRG showed significant difference compared to MG. These findings corroborate those reported by Sabino Neto et al., who employed IPAQ to assess the physical activity of patients subjected to reconstruction or mastectomy alone and found higher levels of physical activity among the former.<sup>22</sup>

Vardar-Yagli et al. applied IPAQ to assess the level of physical activity of 40 patients three years after breast cancer treatment; 57.5% of the patients reported a moderate level and 40% a low level of physical activity.<sup>23</sup> Similarly, most of the patients from all the groups in the present study reported a moderate level of physical activity (73%, 64%, and 69% in BCG, MG, and BRG, respectively). However, the authors did not specify the type of surgical treatment received by the participants.<sup>24</sup>

Recent studies demonstrated the importance of physical activity for breast cancer survivors, including its direct impact on their quality of life and possible benefits in terms of reduced risk of death and relapse.<sup>9,25</sup> Therefore, programs to stimulate physical activity targeting patients with breast cancer are crucial. Lahart et al. found a significant increase in physical activity levels among breast cancer survivors who participated in a program involving moderate to vigorous exercise 150 min per week compared to those in a group who performed standard care measures only.<sup>26</sup> Kuijpers et al. applied the SF-36 and IPAQ to 92 breast cancer

survivors during four months by means of an interactive portal that included patient education and physical activity support and observed an increase in the physical activity level.<sup>24</sup>

In the functional capacity assessment (HAQ-20), only MG exhibited poorer results than the noncancer participants; the remaining groups did not exhibit any significant difference. Enger and Bernstein also found poorer functional capacity, including limitations for work and activities of daily living among women subjected to mastectomy.<sup>27</sup> Despite the limitations of the present study, including its cross-sectional design, the lack of difference between CG and BRG suggests that breast reconstruction might re-establish the functional capacity of patients. Kokuba et al. also did not observe a decrease in functional capacity as assessed by HAQ-20 six months after breast reconstruction using the TRAM flap technique.<sup>28</sup>

Relative to the quality of life, MG exhibited the lowest scores on most SF-36 domains, which corroborates with the results reported in other studies.<sup>25,29,30</sup> MG exhibited a significant difference in the domain "general health" compared to all other groups. Similar results were reported in other studies, which suggests that cancer diagnosis and removal of a body part influence patient psychological status, self-esteem, and self-perception of health.<sup>25,26</sup>

BCG exhibited the poorest scores for the domain "physical functioning." Howes et al. found that women subjected to breast-conserving surgery exhibited poorer results for pain and discomfort than women with no history of breast cancer or subjected to reconstruction following mastectomy.<sup>31</sup> While breast-conserving surgery is considered to be less mutilating, the esthetic outcomes might be poor due to asymmetry and tissue fibrosis resulting from radiotherapy, which is a part of this therapeutic modality.<sup>32</sup>

BRG showed significant difference compared to CG for the domains "physical role functioning" and "emotional role functioning," as was the case for the remainder of the groups, who had lower scores than BRG. The literature includes reports of poorer scores for the domain "physical role functioning" among patients with breast cancer than noncancer women in association because of the problems related to the presence of lymphedema, reduced muscle strength, and reduced joint range of motion following mastectomy, radiotherapy, and lymph node dissection.<sup>33</sup> However, in a prospective study on quality of life, Elder et al. found that one year after immediate breast reconstruction, the scores of patients were the same as those of women from the general population. This effect was not detected for BRG in the present study, and we did

not perform a separate analysis of patients subjected to immediate or delayed breast reconstruction.<sup>34</sup>

The scores for the domain “social role functioning” were homogeneous among the groups. This finding suggests that esthetic discomfort may be minimized by return to work and the support received from friends, care providers, and the family, regardless of the treatment received.<sup>35</sup>

The scores for the domain “emotional role functioning” differed significantly among the three groups of patients subjected to surgical treatment for breast cancer and the noncancer group. These findings are consistent with those reported by Hagen et al., who assessed 196 patients one to two years after treatment for breast cancer and found that 76% of patients reported occurrence of fatigue, anxiety, and depression compared to women without a history of breast cancer.<sup>36</sup>

The present study has limitations, which should be considered in the interpretation of its results. One limitation of the study is its cross-sectional design; a prospective study would have increased the external validity of the results. Additionally, we did not consider the participants’ dominant side (right or left) or the side affected by disease, and thus, we could not investigate possible associations between the dominant side, side subjected to surgery, and performance of axillary lymph node dissection with physical activity level and functional capacity. Finally, we did not consider whether breast reconstruction was immediate or delayed.

While the literature includes studies that assessed the level of physical activity among patients with breast cancer, none compared patients subjected to different treatment modalities to women without a history of breast cancer; the present study is the first of its kind.<sup>10,20,23,37</sup>

## Conclusion

Patients subjected to breast reconstruction exhibited higher levels of physical activity and quality of life than patients subjected to mastectomy alone or breast-conserving surgery.

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## Conflict of interest statement

All the authors state no conflicts of interest.

## Ethical approval

The study was approved by the Research Ethics Committee of the Universidade Federal de São Paulo, Brazil (approval no. 188717).

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