ORIGINAL ARTICLE
https://doi.org/10.29289/2594539420220015

Home exercise adherence after breast cancer surgery: incidence and risk factors

Clarice Gomes Chagas Teodózio[1], Vivian de Freitas Martins da Silva[1], Suzana Sales de Aguiar[1], Luiz Claudio Santos Thuler[1], Anke Bergmann[1]*

ABSTRACT

Introduction: Functional limitations in women undergoing breast cancer treatment are common and have negative impacts during patient treatment. Physical exercise after breast cancer surgery has been shown to be safe and beneficial, as well as necessary during all stages in order to minimize the negative impact of complications that compromise functionality. This study aims to assess adherence to home exercises and associated factors in women undergoing breast cancer surgery. **Methods:** A prospective cohort study with an inclusion of women with indication for curative breast cancer surgery and an axillary approach. During the postoperative period, patients were instructed to perform home exercises and received a home guide that should be completed daily for 30 days. Patient adherence and perception about exercise difficulty and discomfort, and the presence of pain, insecurity and fear were assessed. A descriptive analysis of socio-demographic and clinical variables was performed, and a simple logistic regression was carried out to identify whether symptoms interfered with exercise adherence. **Results:** A total of 465 women were included, of which 43.6% fully adhered to the exercises, 31.6% partially adhered, and 24.7% either did not deliver the home guide, delivered it blank or containing illegible information. Arm discomfort was the most frequent subjective symptom (63.1%), followed by pain (51.6%). No variables were associated to exercise adherence. **Conclusions:** Patients undergoing breast cancer surgery presented total (43.6%) or partial (31.6%) exercise adherence in the first thirty postoperative days. Subjective symptoms and patient perception did not interfere in exercise adherence rates.

KEYWORDS: breast neoplasms; surgery; exercise; patient compliance; treatment adherence and compliance.

INTRODUCTION

In Brazil, 66,280 new cases of breast cancer have been estimated for each year of the 2020-2022 triennium, with an estimated risk of 56.33 cases per 100,000 women[1]. Breast cancer treatment may involve radiation therapy, chemotherapy, hormone therapy, target therapy and surgery. The surgical approach is the standard treatment and the type of surgery varies according to cancer stage, being radical or conservative[2].

Post-surgical breast cancer complications include early edema, pain, paraesthesias, axillary web syndrome, decreased muscle strength, and reduced range of motion (ROM) of the involved limb, directly affecting the return to daily living activities and quality of life[3-7]. In addition to functional limitations, women undergoing breast cancer treatment are exposed to impacts in the psychosocial realm, with the possibility of a state of emotional need deprivation, generating psychological stress, such as changes in self-image, fear of evolution and anxiety concerning the return to professional activities, with negative impacts during patient treatment[8,9].

Physical exercise in women undergoing breast cancer treatment has been shown to be safe and beneficial, as well as necessary during all stages in order to minimize the negative impact of complications that compromise functionality[10-12]. Upper limb mobilization, in addition to improving functionality, positively interferes with self-confidence, encouraging the patient to continue the exercises in order to maintain daily, work and leisure activities. Unfortunately, low adherence to interventions is constantly reported in studies that recommend exercise for cancer patients, reaching approximately 32-42% of the studied populations[11,13-15].

Factors associated with good adherence to exercises are generally associated to the bond between therapist and patient, achieved through professional welcoming and commitment and the perception of the benefits obtained from therapy and family support. Factors that hinder adherence include lack of time, work commitment, lack of interest, health conditions, treatment side effects and discouragement[16,17].

[1]Instituto Nacional de Câncer José Gomes de Alencar, Clinical Research Division – Rio de Janeiro (RJ), Brazil.
***Corresponding author:** abergmann@inca.gov.br
Conflict of interests: nothing to declare. Funding: none.
Received on: 05/25/2022. **Accepted on:** 07/11/2022.

Exercise adherence is an important indicator of health care effectiveness, but no consensus on its definition and measurement is available, especially since the exercises are carried out at home, with no direct professional presence and participation[16,18-20]. Adherence to an exercise program, proposed by controlled studies, such as clinical trials, is essential for adequate results[21]. A better understanding of which factors hinder or facilitate exercise adherence may serve as a guide for future interventions and facilitate the therapeutic response of home exercise programs, in order to assist in restored function and in the return to daily and professional activities, identifying whether any subgroups are more prone to non- or low adherence[21].

In this scenario, the aim of the present study was to assess adherence to home exercises and associated factors in women undergoing breast cancer surgery.

METHODS

This study comprised a prospective cohort study including women aged between 18 and 79, with indication for curative surgery and an axillary approach, for breast cancer treatment at *Hospital do Câncer* III / the Brazilian National Cancer Institute (*HCIII-INCA*), from February 01, 2019 to December 20, 2019. This study was approved by the INCA Research Ethics Committee, under no. 2.462.767 on January 9, 2018, and is part of a clinical trial registered at the National Library of Medicine (ClinicalTrials.gov Identifier: NCT03796845). The details of the study protocol have been previously published[22].

The following patients were excluded: patients presenting bilateral breast cancer; anyone who had undergone previous surgical and/or radiotherapeutic breast cancer treatment; with indication for immediate breast reconstruction surgery; with functional upper limb changes prior to breast cancer surgery; and those who were unable to read, understand and/or complete the home guide. Eligible patients who agreed to participate in the study signed a Free and Informed Consent Form.

Patients were evaluated in the preoperative period, in an individual and group care, as a routine of Physiotherapy in order to carry out functional diagnoses and provide guidance on the prevention of complications.

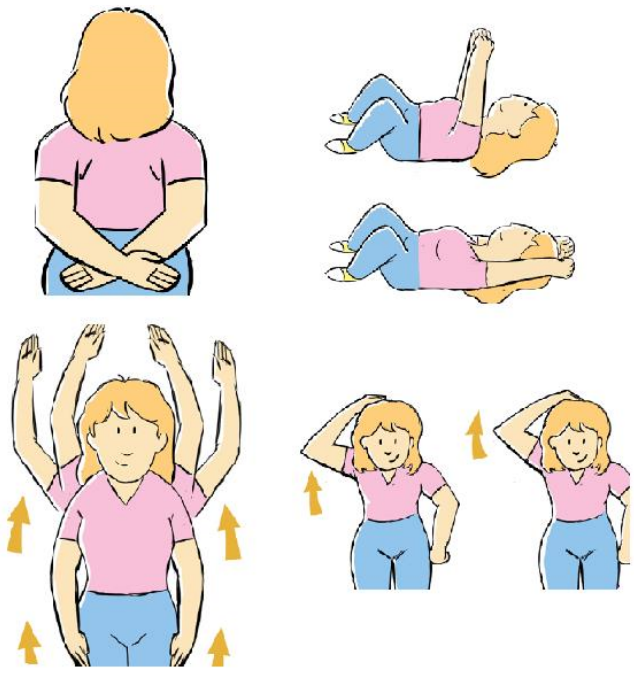
On the first postoperative day, the patients received an instructional booklet (Figure 1) related to post-operative exercises and guidance, and were instructed on the need to perform home exercises. Women were randomized in two interventions groups. One performed restricted shoulder exercises with amplitude of movement above 90º, and the other with free amplitude of movement over 90º. They were taught four shoulder exercises, which had to be performed daily, three times a day. Patients returned to the physiotherapy service 30 days after surgery for a new evaluation[3].

In order to verify the performance of the proposed exercises, a home guide was delivered on the first day after surgery, which should be filled out by the patient daily, and delivered in the physiotherapy appointment 30 days after the surgery, following the established institutional routine.

The women were informed of the need to carry out the guidelines and provide accurate and real information regarding the symptoms and effects caused by the exercises. The home guide contained questions regarding exercise, frequency and subjective symptoms, such as the presence of pain, discomfort, difficulty, fear and insecurity when performing home exercises. All subjective symptoms were strictly related to upper limb mobilization.

The analysis of the exercise adherence was performed by completing the home guide, which also allowed for assessments concerning the patient's perception of the exercises. The following outcomes were analyzed: total, partial, no information or non-adherence. Total adherence was defined as performing the exercises three times a day on all days during the intervention weeks (regular frequency); partial adherence was considered when the exercises were performed less than three times a day every day or performed only a few days during the intervention weeks (irregular frequency). Non-adherence was considered when patients inform that did not perform exercises any day. Patients who did not deliver the home guide, delivered it blank or containing illegible information were considered as no information because we cannot assume that patients were adherent or not.

Sociodemographic and clinical data were collected through interviews and complemented by physical and electronic medical records analyses. All patients were assessed by the same physiotherapy team, according to the established service routine.



Source: https://www.inca.gov.br/sites/ufu.sti.inca.local/files//media/document//mastologia-2017.pdf

Figure 1. Instruction booklet for home exercises.

Statistical analyses

To calculate the sample size, an outcome (adherence) of 65% with an accuracy of 5% was considered, at a 95% confidence interval. With these parameters, 350 women would be required. However, all women who met the eligibility criteria during the study period were included, totaling 465 participants.

A descriptive analysis of the distribution of the continuous variables of the study was carried out from the collected information filed in a database, through central tendency and dispersion measures, while frequency distributions were used for categorical variables. A simple logistic regression was performed to identify the association between the presence of subjective symptoms and exercise adherence. The statistical analyses were performed using the Statistical Package for Social Sciences (SPSS), version 20.0.

RESULTS

A total of 465 women who were followed up for 30 days after surgery for breast cancer were included in this study. Of this total, a loss of follow-up was observed for four (0.8%) participants due to the following reasons: failure to return to the appointment (n=2) and hospitalization for reasons not related to the surgical approach (n=2).

The 461 women who completed the 30-day follow-up had a mean age of 54 (±11.54), 56.8% had a Body Mass Index (BMI) <30kg/m^2 and were predominantly non-white (66.9%), living without a partner (52.7%) and undergoing some professional activity (53.5%). Regarding comorbidities, 43.9% had arterial hypertension. Concerning clinical and treatment characteristics, 53.3% presented initial clinical staging <IIB, 56.3% underwent neoadjuvant treatment, predominantly with chemotherapy. With regard to the type of surgery, 56.8% underwent mastectomies, with 46.5% undergoing axillary lymphadenectomy (Table 1).

With regard to adherence to home exercises in the thirty days after surgery, 43.6% exhibited total adherence, 31.6% presented partial adherence, 24.7% had missing data, and 0.0% exhibited non-adherence. No statistically significant difference was observed concerning adherence to exercises according to sociodemographic, clinical characteristics or interventions groups (Table 1).

Concerning the subjective symptoms reported in the period of 30 days after surgery, arm discomfort when performing the exercises was present in most patients (63.1%), followed by the presence of upper limb pain (51.6%), difficulty in performing the exercises (49.2%), insecurity (45.5%), and fear of upper limb mobilization (44.9%). The patients' symptoms and perceptions were not associated with home exercise adherence (Table 2).

DISCUSSION

In this study, adherence to home exercises was evaluated daily on the first 30 postoperative days through patient self-reports in a home guide covering exercise performance and the existence of subjective symptoms related to upper limb mobilization. At the end of the thirty-day period, 43.6% of the patients exhibited total adherence to the exercises, 31.6% presented partial adherence and 24.7% did not deliver the home guide, delivered it blank or containing illegible data. Among the evaluated symptoms, discomfort was the most reported (63.1%), followed by arm pain (51.6%), difficulty in performing the exercises (49.2%), insecurity (45.5%) and fear (44.9%).

This form of assessment is seldom mentioned in scientific studies and is commonly associated with attendance to appointments or prescription exercise parameters (series, number of repetitions and intensity). Care was taken so that the guidance provided on the performance /benefit of the proposed exercises and guide completion was reinforced for full understanding by the patients and their families.

Petito et al. included 64 women undergoing radical and conservative surgical treatment in a study to assess the effectiveness of an exercise program in recovering shoulder range of motion from the preoperative period, with reassessments from the 7–105th postoperative day, and with the specific purpose of evaluating patient adherence to the program. Self-reporting was used as a way of measuring adherence, considering satisfactory when carried out for five to seven days a week at least once a day, and unsatisfactory when performed equal to or less than four times a week. The authors observed that exercise adherence is greater in the initial postoperative periods, decreasing over the weeks[23].

Cnossen et al. investigated adherence in 50 patients with head and neck cancer using a home exercise program during and after six weeks of chemotherapy. The adherence measurement was performed through diaries filled out daily by the patients, consisting of three levels of adherence: low adherence, when the exercises were performed once a day; moderate, when performed once or twice a day, and high, when performed two or more times a day. A total of 40% of the patients displayed low adherence, 34% exhibited moderate adherence, and 26%, high adherence[14]. The patients in the present study were evaluated for 30 days, which may have facilitated the high percentage of total exercise adherence (43.6%).

Gutiérrez et al. reported on patients adherence to an exercise program with follow-up between the immediate postoperative breast cancer period and the first outpatient return visit (7 or 10th day), assessed through self-reporting, where patients considering themselves as adhering to the intervention when practicing the exercises as recommended, daily, but also including those with less daily frequency, totaling 64.2%. Non-adherence was considered when patients reported not performing the exercises or performing them irregularly, at 35.8%. The high adherence reported

Table 1. Characterization of the total study population and among adherence groups

Characteristics	Total n (%) 465	Partial adhesion n (%) 147 (31.6)	Total adhesion n (%) 203 (43.7)	No information n (%) 115 (24.7)	p-value†
Age (Years)					
Means (SD)	54.53(±11.54)	54.63 (±11.33)	54.22 (±11.33)	54.97 (±11.64)	0.744
Body mass index					
<30kg/m²	264 (56.8)	82(55.8)	117 (57.6)	65 (56.5)	0.730
≥30kg/m²	201 (43.2)	65 (44.2)	86 (42.4)	50 (43.5)	
Race/Skin color*					
White	154 (33.1)	48 (32.7)	71 (35.0)	80 (69.6)	0.651
Non-white	311 (66.9)	99 (67.3)	132 (65.0)	35 (30.4)	
Marital status					
No partner	245 (52.7)	74 (50.3)	104 (51.2)	67 (58.3)	0.869
With partner	220 (47.3)	73 (49.7)	99 (48.8)	48 (41.7)	
Schooling					
<8 years	103 (22.2)	34 (23.1)	35 (17.2)	34 (29.6)	0.172
>=8 years	362 (77.8)	113 (76.9)	168 (82.8)	81 (70.4)	
Professional activity					
Yes	249 (53.5)	79 (54.1)	113 (55.9)	57 (49.6)	0.735
No	214 (46.0)	67 (45.9)	89 (44.1)	58 (50.4)	
No information	2 (0.4)				
Systemic Arterial Hypertension					
Yes	204 (43.9)	60 (40.8)	88 (43.3)	56 (48.7)	0.636
No	261 (56.1)	87 (59.2)	115 (56.7)	59 (51.3)	
Diabetes					
Yes	74 (15.9)	19 (12.9)	35 (17.2)	20 (17.4)	0.270
No	391 (84.1)	128 (87.1)	168 (82.8)	95 (82.6)	
Clinical staging					
Initial (<IIB)	248 (53.3)	86 (57.8)	100 (49.3)	63 (54.8)	0.113
Advanced (≥IIB)	217 (46.7)	62 (42.2)	103 (50.7)	52 (45.2)	
Neoadjuvant treatment					
Yes	262 (56.3)	80 (54.4)	117 (57.6)	65 (56.5)	0.550
No	203 (43.7)	67 (45.6)	86 (42.4)	50 (43.5)	
Neoadjuvant chemotherapy					
Yes	257 (55.3)	78 (53.1)	116 (57.1)	63 (54.8)	0.448
No	208 (44.7)	69 (46.9)	87 (42.9)	52 (45.2)	
Neoadjuvant hormone therapy					
Yes	154 (33.1)	46 (31.3)	70 (34.5)	38 (33.0)	0.531
No	311 (66.9)	101 (68.7)	133 (65.5)	77 (67.0)	
Neoadjuvant target therapy					
Yes	61 (13.1)	19 (12.9)	26 (12.8)	16 (13.9)	0.974
No	404 (86.9)	128 (87.1)	177 (87.2)	99 (86.1)	
Type of surgery					
Segmentectomy	201 (43.2)	69 (46.9)	79 (38.9)	53 (46.1)	0.134
Mastectomy	264 (56.8)	78 (53.1)	124 (61.1)	62 (53.9)	
Axillary Approach					
Axillary lymphadenectomy	216 (46.5)	71 (48.3)	93 (45.8)	52 (45.2)	0.645
Sentinel Lymph Node Biopsy	249 (53.5)	76 (51.7)	110 (54.2)	63 (54.8)	
Interventions group					
Free amplitude of movement	254 (54.6)	85 (57.8)	112 (55.2)	57 (49.6)	0.622
Restricted amplitude of movement	211 (45.4)	62 (42.2)	91 (44.8)	58 (50.4)	

*Non-white=black (n=100), brown (n=210), indigenous (n=1). †Comparison between partial and total adherence groups. Q-square test.

Table 2. Distribution of factors associated with partial and total adherence groups

Symptoms	Total n (%) 461	Partial adhesion 147(42.0%)	Total adhesion 203 (58.0%)	OR (95%CI)	p-value†
Arm pain					
Yes	240 (51.6)	101 (71.6)	139 (68.8)	1.14 (0.714–1.83)	0.575
No	103 (22.2)	40 (28.4)	63 (31.2)		
No information	122 (26.2)				
Arm discomfort					
Yes	291 (63.1)	120 (84.5)	171 (84.7)	0.98 (0.54–1.79)	0.970
No	53 (11.4)	22 (15.5)	31 (15.3)		
No information	121 (26.0)				
Difficulty in performing the exercises					
Yes	229 (49.2)	96 (68.6)	133 (66.2)	1.11 (0.70–1.76)	0.642
No	112 (24.1)	44 (31.4)	68 (33.8)		
No information	124 (26.7)				
Fear of performing the exercises					
Yes	211 (44.9)	92 (65.7)	117 (57.9)	1.39 (0.89–2.17)	0.146
No	133 (28.6)	137 (34.3)	85 (42.1)		
No information	123 (26.5)				
Insecurity to perform the exercises					
Yes	211 (45.4)	90 (64.3)	121 (59.9)	1.20 (0.77–1.88)	0.412
No	131 (28.2)	50 (35.7)	81 (40.1)		
No information	123 (26.5)				

OR: odds ratio. †Comparison between partial and total adherence groups. Logistic regression.

by the authors may be related to the low time interval assessed (up to the 7 or 10th postoperative day), which seems to facilitate patient compliance. In addition, the authors also identified patient difficulties impacting exercise adherence. The reasons related to non-compliance or impossibility to perform the exercises included fear of feeling pain, fear of performing the exercise and affecting the surgical wound site, lack of courage when trying and/or performing the exercises, and pain when trying and/or performing the exercises, with the latter being the main symptom (35.8%)[11]. In the present study, 51.6% of the participants reported pain, but discomfort during the exercise was the most frequent symptom, reported by almost two-thirds of the population (63.1%).

Regarding the associated factors related to adherence, Cnossen et al. found that exercise performance levels were not associated with age, gender, tumor site, tumor stage, but were associated with symptoms related to difficulty opening the mouth. Petito et al. found no difference between the surgical approach and the impact on adherence groups. And Gutierrez et al. identified that fear of feeling pain, fear of affecting the site of the surgical wound and pain when performing exercise impact on exercise adherence. In the present study, no statistically significant difference was observed regarding adherence to exercises according to sociodemographic, clinical, intervention groups or symptoms and patient perception (p>0.005).

Amaral et al. compared the effectiveness of a home program with a supervised exercise program, assessing 56 women who underwent breast cancer surgery constantly monitored and reassessed for two months. No difference in ROM recovery was noted between groups. In addition, both groups showed low adherence to the exercises. The authors indicate that the reasons impacting the low adherence of the home group included functional ROM gain and difficulty in understanding the booklet, while for the supervised group, difficult access to the place of care for economic reasons or climatic variations (high temperatures) were reported[13].

Lokapavani et al. analyzed the influence of preoperative physical therapy on shoulder ROM in 30 women undergoing modified radical mastectomy, categorized into two groups, where the intervention group received education and preoperative exercises two weeks before surgery, and the control group received a standard education leaflet, and both groups were followed up for one month after surgery. Shoulder ROM was recovered in both groups, but the intervention group reached the functional ROM required to perform daily living activities. Preoperative evaluation provides greater understanding of the surgical procedure and related aspects, such as drains, wound healing complications, seroma and physical-functional complications. The authors conclude that this information availability physically and mentally prepare the patient for surgery[24].

Strengths and limitations

The limitations of the present study include performance of exercises without direct supervision, which may have negatively interfered in patient adherence, since one of the factors related to exercise adherence is the therapist-patient bond[17]. In addition, home guide self-completion may be susceptible to information bias, in accordance to Cnossen et al.[14].

However, some strengths of the present study should also be highlighted. Although the present study evaluates exercise adherence after breast cancer surgery, pre and postoperative assessments and guidance were carried out in order to reduce the incidence of dysfunction of the upper limb homolateral to the surgery, and to guide the patient on the surgery and its functional effects. Another positive aspect of this study is the short follow-up time, which may have facilitated patient commitment to home guide completion, in addition to the robust sample size that may have provided greater statistical power to the results. It is also noteworthy that the study was carried out in a service whose professionals have extensive experience with patient treatment during the postoperative breast cancer period, allowing for uniform procedures and guaranteeing the quality of the intervention.

CONCLUSIONS

Patients who underwent surgery for breast cancer treatment exhibited total adherence (43.6%) and partial adherence (31.6%) to home exercises during the first thirty postoperative days, with discomfort as the main reported symptom. No factors associated with adherence to home exercises for 30 days after surgery were observed.

ACKNOWLEDGEMENTS

We would like to thank all patients, the nursing and physiotherapy departments of *Hospital do Câncer III* of the Brazilian National Cancer Institute for their contribution to this study.

AUTHORS' CONTRIBUTION

CGCT: Conceptualization, Data curation, Formal Analysis, Project administration, Writing – original draft. VFMS: Data curation, Formal Analysis, Writing – original draft. SSA: Conceptualization, Formal Analysis. LCST: Conceptualization, Data curation, Formal Analysis, Writing – original draft. AB: Conceptualization, Data curation, Formal Analysis, Writing – original draft.

REFERENCES

1. Instituto Nacional de Câncer José Gomes de Alencar. Estimativas da incidência e mortalidade por câncer. Rio de Janeiro: INCA; 2020.
2. Instituto Nacional de Câncer José Gomes de Alencar. Ações e programas. Rio de Janeiro: INCA; 2016.
3. Bergmann A, Ribeiro MJP, Pedrosa E, Nogueira EA, Oliveira ACG. Physical therapy in breast cancer: clinical protocol at the Cancer Hospital III/INCA. Rev Bras Cancerol. 2006;52(1):97-109.
4. Pereira ACPR, Koifman RJ, Bergmann A. Incidence and risk factors of lymphedema after breast cancer treatment: 10 years of follow-up. Breast. 2017;36:67-73. https://doi.org/10.1016/j.breast.2017.09.006
5. Macedo FO, Bergmann A, Koifman RJ, Torres DM, Costa RM, Silva IF. Axillary surgery in breast cancer: acute postoperative complications in a hospital cohort of women of Rio de Janeiro, Brazil. Mastology. 2018;28(2):80-6. https://doi.org/10.29289/259453942018000377
6. Lee SA, Kang JY, Kim YD, An AR, Kim SW, Kim YS, et al. Effects of a scapula-oriented shoulder exercise programme on upper limb dysfunction in breast cancer survivors: a randomized controlled pilot trial. Clin Rehabil. 2010;24(7):600-13. https://doi.org/10.1177/0269215510362324
7. Yang EJ, Kang E, Kim SW, Lim JY. Discrepant trajectories of impairment, activity, and participation related to upper-limb function in patients with breast cancer. Arch Phys Med Rehabil. 2015;96(12):2161-8. https://doi.org/10.1016/j.apmr.2015.08.426
8. Silva G, Santos MA. Stressors in breast cancer post-treatment: a qualitative approach. Rev Lat Am Enfermagem. 2010;18(4):688-95. https://doi.org/10.1590/s0104-11692010000400005
9. Izydorczyk B, Kwapniewska A, Lizinczyk S, Sitnik-Warchulska K. Psychological resilience as a protective factor for the body image in post-mastectomy women with breast cancer. Int J Environ Res Public Health. 2018;15(6):1181. https://doi.org/10.3390/ijerph15061181
10. Lee CE, Von Ah D, Szuck B, Lau YK. Determinants of Physical Activity Maintenance in Breast Cancer Survivors After a Community-Based Intervention. Oncol Nurs Forum. 2016;43(1):93-102. https://doi.org/10.1188/16.ONF.43-01AP
11. Gutiérrez MGR, Bravo MM, Chanes DC, Vivo MCR, Souza GO, et al. Adherence to an early rehabilitation program among women who underwent mastecmoty. Acta Paul Enferm. 2007;20(3):249-54. https://doi.org/10.1590/S0103-21002007000300002
12. Ribeiro IL, Moreira RFC, Ferrari AV, Alburquerque-Sendín F, Camargo PR, Salvini TF. Effectiveness of early rehabilitation on range of motion, muscle strength and arm function after breast cancer surgery: a systematic review of randomized controlled trials. Clin Rehabil. 2019;33(12):1876-86. https://doi.org/10.1177/0269215519873026
13. Amaral MTP, Teixeira LC, Derchain SFM, Nogueira MD, Pinto e Silva MP, Gonçalves AV. Orientação domiciliar: proposto de reabilitação física para mulheres submetidas à cirurgia por câncer de mama. Rev Ciênc Méd. 2012 [cited on Dec 8, 2020];14(5):405-13. Available from: https://seer.sis.puc-campinas.edu.br/cienciasmedicas/article/view/1151

14. Cnossen IC, van Uden-Kraan CF, Witte BI, Aalders YJ, Goede CJ, Bree R, et al. Prophylactic exercises among head and neck cancer patients during and after swallowing sparing intensity modulated radiation: adherence and exercise performance levels of a 12-week guided home-based program. Eur Arch Otorhinolaryngol. 2017;274(2):1129-38. https://doi.org/10.1007/s00405-016-4367-9

15. Sagen A, Kaaresen R, Sandvik L, Thune I, Risberg MA. Upper limb physical function and adverse effects after breast cancer surgery: a prospective 2.5-year follow-up study and preoperative measures. Arch Phys Med Rehabil. 2014;95(5):875-81. https://doi.org/10.1016/j.apmr.2013.12.015

16. Essery R, Geraghty AW, Kirby S, Yardley L. Predictors of adherence to home-based physical therapies: a systematic review. Disabil Rehabil. 2017;39(6):519-34. https://doi.org/10.3109/09638288.2016.1153160

17. Telles TCB, Araruna LC, Almeida MS, Melo AK. Adhesion and adherence to exercise: a bibliographical study. Rev Bras Psicol Esporte. 2016;6(1):109-20. https://doi.org/10.31501/rbpe.v6i1.6725

18. Sant'anna KD, Almeida V, Petito EL, Gutierrez MGR. Adherence to the practice of exercises for functional rehabilitation of women with breast cancer: a literature review. Cienc Enferm. 2010;16(1):97-104. http://doi.org/10.4067/S0717-95532010000100011

19. Rafn BS, Hung S, Hoens AM, McNeely ML, Singh CA, Kwan W, et al. Prospective surveillance and targeted physiotherapy for arm morbidity after breast cancer surgery: a pilot randomized controlled trial. Clin Rehabil. 2018;32(6):811-26. http://doi.org/10.1177/0269215518757292

20. Matarán-Peñarrocha GA, Palomo ICL, Soler EA, Gil-Martínez E, Fernández-Sánchez M, Aguilar-Ferrándiz ME, et al. Comparison of efficacy of a supervised versus non-supervised physical therapy exercise program on the pain, functionality and quality of life of patients with non-specific chronic low-back pain: a randomized controlled trial. Clin Rehabil. 2020;34(7):948-59. http://doi.org/10.1177/0269215520927076

21. Kampshoff CS, van Mechelen W, Schep G, Nijziel MR, Witlox L, Bosman L, et al. Participation in and adherence to physical exercise after completion of primary cancer treatment. Int J Behav Nutr Phys Act. 2016;13(1):100. http://doi.org/10.1186/s12966-016-0425-3

22. Teodózio CGC, Marchito LO, Fabro EAN, Macedo FO, Aguiar SS, Thuler LCS, et al. Shoulder amplitude movement does not influence postoperative wound complications after breast cancer surgery: a randomized clinical trial. Breast Cancer Res Treat. 2020;184(1):97-105. http://doi.org/10.1007/s10549-020-05826-9

23. Petito EL, Nazário AC, Martinelli SE, Facina G, Gutiérrez MG. Application of a domicile-based exercise program for shoulder rehabilitation after breast cancer surgery. Rev Lat Am Enfermagem. 2012;20(1):35-43. http://doi.org/10.1590/s0104-11692012000100006

24. Lokapavani Y, Krishna SR, Madhavi K. Influence of preoperative physical therapy education and exercise on post-operative shoulder ranger of motion and functional activities in subjects with modified radical mastectomy. Int J Physio. 2014[cited on Dec 8, 2020];1(4):170-7. https://doi.org/10.15621/ijphy/2014/v1i4/54556

This is an open access article distributed under the terms of the Creative Commons license.