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# Kinesiophobia is associated with worse functionality after breast cancer surgery

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## ABSTRACT

**Introduction:** Kinesiophobia has been reported as a determining factor for dysfunction associated with pain and daily living activity alterations in breast cancer patients. This study aimed to identify the frequency and factors associated with kinesiophobia concerning upper limb exercises during the first month after surgery for breast cancer treatment. **Methods:** Women aged 18 to 79 years with indication for curative breast cancer with an axillary surgery were instructed to perform shoulder exercises with either free or restricted range of motion at home. They returned 30 days after surgery, when kinesiophobia was assessed using the Tampa Scale for Kinesiophobia questionnaire. **Results:** The study included 298 women. Of these, 64 (21.5%) lost the follow-up, totaling 234 (78.3%) who were assessed for kinesiophobia. Participants with declining functionality and difficulty performing the prescribed exercises worsened 3.19 (95% confidence interval [CI] 0.93 to 5.45; p=0.006) and 2.95 (95%CI 0.30 to 5.41; p=0.019) kinesiophobia score points, respectively, while those who performed professional activities exhibited an improvement of -2.45 (95%CI -4.58 to -0.33) kinesiophobia score points. **Conclusion:** The breast cancer patients who exhibited poorer functionality and greater difficulty performing the prescribed exercises after surgical treatment exhibited higher kinesiophobia scores, while those who performed professional activities presented lower scores.

KEYWORDS: breast cancer; surgery; exercise; kinesiophobia; cooperation and adherence to treatment.

## INTRODUCTION

The most common cancer type among women worldwide, excluding nonmelanoma skin cancer, is breast cancer[1]. The main treatment for this condition is surgery. However, although different therapies are available, performed either jointly or unaccompanied, with the latter increasingly individualizing treatment, many women must still deal with common postsurgery upper limb dysfunctions[2-4].

Depending on the extension of the surgery, functional complications in the residual breast region can occur for months or even years thereafter in the plastron and in the upper limb ipsilateral to the surgery[5-7]. The main complications that negatively impact daily and professional life activities include pain, intercostobrachial paresthesia, lymphedema, winged scapula, axillary web syndrome, and decreased shoulder range of motion[3,6,8].

Shoulder movement disorders resulting from the surgical procedure can be aggravated by upper limb immobilization[3,6,8,9]. Therefore, the importance of performing shoulder exercises during the early postoperative period is emphasized in order to maintain its range of motion and functionality and decrease certain symptoms, such as pain and paresthesia[7,10-12]. However, patients often adopt an immobilization posture during the immediate postoperative period due to a lack of guidance from the health team, fear of arm mobilization, or protection from family, who perform activities for the patient[13-16]. De Groef et al. related that women still report upper limb dysfunction as a symptom one year after breast cancer surgery.[7]

Kinesiophobia, defined as an excessive and irrational fear of movement or activity due to the feeling that it may generate pain or result in an injury, has been reported as a determining factor for dysfunction associated with pain and daily living activity alterations[17-19]. Therefore, the identification of kinesiophobia-generating factors is required to allow the development of strategies able to minimize this fear. This, in turn, improves

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exercise adherence in an attempt to decrease shoulder dysfunctions, with repercussions on patient quality of life improvements. Furthermore, this also facilitates professional life return and social reintegration. To the best of our knowledge, however, no studies evaluating kinesiophobia in 30 days after breast cancer surgery and its association with upper limb functionality are available. In this context, the aim of the present study was to identify the frequency and factors associated with kinesiophobia concerning upper limb exercises in patients during the first month after breast cancer surgery.

## METHODS

This study is a secondary analysis using data from a published previously randomized controlled trial. The study evaluated the influence of shoulder exercises with restricted amplitude movement (RAM) or free amplitude movement (FAM) performed from the first postoperative day on the incidence of surgical wound complications in breast cancer. It was conducted in a hospital reference in breast cancer treatment in Rio de Janeiro, Brazil. It was approved by the Brazilian National Institute of Cancer (INCA, Instituto Nacional de Câncer) research ethics committee under nº 2.464.767 and registered at the National Library of Medicine (ClinicalTrials.gov, identifier: NCT03796845).

In summary, 465 patients were randomized to each exercise group and were followed up to 30 days postoperatively. The main results showed that FAM exercises are safe and do not increase the risk of wound postoperative complications after breast cancer surgery.

### Patients

The Tampa Scale was introduced into the study only a few months after the beginning of the randomized controlled trial. Due to this, we analyzed the participants included from May 1, 2019 until the end of the recruitment.

The inclusion criteria comprised women aged between 18 and 79 with indication for curative breast cancer surgery with an axillary approach at INCA from May 1 to December 20, 2019. The exclusion criteria involved: diagnosis of bilateral breast cancer; history of previous surgical and/or radiotherapy treatment for breast cancer; indication for immediate breast reconstruction surgery; presence of functional upper limb changes during the preoperative period; and inability to read, understand, and/or complete the home guide. All patients eligible and who agreed to participate in the study signed a free and informed consent form.

### Interventions

The patients were evaluated and advised during the preoperative period regarding the prevention of postoperative complications. On the first postoperative day, the patients were instructed to perform shoulder exercises at home, which should be practiced daily, three times a day, and received an instructional booklet concerning the postoperative exercises and guidelines. The patients were randomized and allocated to one of two groups: the first with free range of motion (ROM), who performed shoulder exercises with a ROM above 90º, and the second, with restricted ROM, who performed exercises limited to 90º until surgical stitch removal. The details of the study protocol were previously published[12].

A home guide (self-elaboration) was given to each patient with the purpose of verifying the execution of the proposed exercises during the postoperative period, which should be completed daily during the 30 days of home exercises. Women were informed of the importance of the exercises and the need to provide accurate and real information regarding any symptoms or effects caused by them. The home guide addressed questions about exercise performance and the presence of symptoms such as pain, discomfort, difficulty, fear, and insecurity during exercise execution.

### Outcome measure

The patients returned to the physiotherapy service 30 days after surgery for a new evaluation, according to the institutional routine[20,21]. At that time, the Tampa Scale for Kinesiophobia (TSK) and the Disabilities of the Arm, Shoulder, and Hand questionnaire (DASH) were administered, and the home guide was collected from each patient. The TSK is a validated questionnaire that was translated to Portuguese which assesses the presence of kinesiophobia through 17 questions addressing pain and symptom intensity[22-24]. The score ranges from 17 to 68, and the higher the score is, the greater the degree of kinesiophobia. The DASH is a validated and reliable questionnaire that was also translated to Portuguese[25], comprising 30 items classified from 1 to 5 that aims to grade physical function and symptoms in people exhibiting upper limb dysfunction. The score ranges from 0 (no dysfunction) to 100 (severe dysfunction)[26].

Sociodemographic and clinical data were collected through interviews and complemented by medical record analyses. All patients were analyzed by the same physiotherapy team, according to a previously established routine[20,21].

### Statistical analysis

The outcome (kinesiophobia), with an expected population standard deviation of 6, was considered for the sample size calculation. According to the t-distribution, the inclusion of 65 women would be necessary to estimate an average kinesiophobia score with 95% confidence interval (CI) and 1.5 precision.

Descriptive analyses of sociodemographic and clinical variables were performed using frequency, central tendency, and dispersion measures. The Kolmogorov–Smirnov test was applied to assess data normality. Pearson's $\chi^2$ test was used for categorical variables, and Student's t-test was used for continuous variables to compare kinesiophobia scores. Variables displaying $p<0.05$ were considered statistically significant.

Simple linear regressions were performed to identify whether patients' perceptions, early surgical wound complications, and functionality interfered with kinesiophobia. Variables with p<0.20 were included in the multiple linear regression, and those with p<0.05 were maintained in the model. A generalized linear model was performed considering the same statistical significance values to compare breast and axillary surgery scores. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS), version 20.0.

## RESULTS

A total of 298 women were included in the study. Of them, 64 (21.5%) did not return for follow-up assessment and were, thus, considered losses. Therefore, 234 (78.3%) patients were included in the kinesiophobia analyses. Concerning the general study population characteristics, 44.3% were hypertensive, 14.4% were diabetic, 48.7% presented advanced clinical staging (≥IIB), 58.1% underwent some neoadjuvant treatment, 57.0% underwent mastectomies, 53.0% underwent sentinel lymph node biopsy (SLB), and 50.3% held external professional activities (Table 1).

The kinesiophobia scores were normally distributed (Kolmogorov–Smirnov test p=0.483) with a mean of 38.06 (standard deviation ±7.68).

Regarding comparisons between kinesiophobia scores and patient characteristics, women submitted to hormone therapy worsened by 2.16 (95%CI 0.16 to 4.16; p=0.034) score points, while those who underwent SLB improved by -2.59 (95%CI -4.54 to -0.63; p=0.010) kinesiophobia score points when compared to those who underwent axillary emptying. Patients who underwent mastectomies with axillary dissection worsened by 2.39 (95%CI 0.15 to 4.63; p=0.037) points compared to those who underwent segmentectomy with SLB. Women who performed work activities improved their kinesiophobia scores by -2.83 (95%CI -4.78 to -0.88; p=0.005) points compared to those who did not work (Table 1).

As for symptoms, patients who experienced pain, discomfort, difficulty, and insecurity while performing home exercises were more likely to exhibit more kinesiophobia than those who did not present these symptoms (p<0.05). The presence of surgical wound complications was not associated with kinesiophobia score differences (p>0.05) (Table 2).

Patients with worsening functionality worsened 3.85 (95%CI 1.91 to 5.79) kinesiophobia score points (Table 2).

The variables included in the multiple regression were: functionality worsening, difficulty performing the exercises, professional activities, an axillary approach, pain and discomfort during exercise execution, hormone therapy, mastectomy with axillary emptying, insecurities, any neoadjuvant treatment, and diabetes (Tables 1 and 2). The following variables were identified as independent factors after analysis: worsening functionality, difficulty performing the exercises and main activities (Table 3).

Participants displaying worsening functionality and difficulty performing the exercises worsened by 3.19 (95%CI 0.93 to 5.45; p=0.006) and 2.95 (95%CI 0.30 to 5.41; p=0.019) kinesiophobia score points, respectively, while those holding professional activities improved by -2.45 (95%CI -4.58 to -0.33) kinesiophobia score points (Table 3).

## DISCUSSION

Patients who underwent surgical breast cancer treatment and exhibited poorer functionality and greater difficulty performing the exercises scored higher on the kinesiophobia scale, while women who performed professional activities displayed lower kinesiophobia scores.

After breast cancer surgery, many women assume a protective posture concerning the surgery region and upper limbs and become afraid of the occurrence of lymphedema and postoperative complications. Therefore, they often avoid using the arm ipsilateral to surgery to perform daily activities[13,16]. Can et al. (2018) evaluated 81 women who underwent breast cancer surgery and identified that 47.5% of those with lymphedema had kinesiophobia (score >37), while 76% of women with kinesiophobia had lymphedema, demonstrating that the fear of performing exercises can, in fact, cause lymphedema. In addition, the study demonstrated that kinesiophobia also increased depression/anxiety and decreased upper limb functionality (p=0.02)[16]. This finding corroborates the results reported herein, where women with worsening functionality exhibited higher kinesiophobia scores (3.19; 95%CI 0.932 to 5.453). Caban et al. (2006) identified an association between increased depression symptom scores in women surgically treated for breast cancer and decreased shoulder ROM (0.920; 95%CI 0.863 to 0.980)[27].

In the present study, professional activity was associated with decreased kinesiophobia, similar to what was described by Caban et al., who demonstrated that independent women engaged in instrumental daily living activities have a greater chance of recovering complete shoulder range than dependent women (82% and 61%, respectively; p=0.002)[27].

Exercises are beneficial for range of motion and functional independence. Fear of performing exercises, therefore, impacts functionality and certain signs, such as lymphedema, which can impact depression and, consequently, affect functionality[3,7,11,16,27]. It can be assumed that kinesiophobia has a negative impact on functionality, range of motion, and depression, thus perpetuating negative results alongside reduced patient independence, increased feelings of uselessness, and finally, decreased social contribution and quality of life[28,29].

Van der Gucht et al. identified that high kinesiophobia scores comprise one of the main factors that influence pain-associated dysfunction in women who survived breast cancer[19]. Leeuw et al., in turn, identified that catastrophic pain in patients with lower

**Table 1.** Association between kinesiophobia and breast cancer patient characteristics.

| Characteristics | Total=234 n (%) | Kinesiophobia mean score (SD) | Kinesiophobia β (95%CI) | p-value† |
|---|---|---|---|---|
| Age | | | 0.03 (-0.05 to 0.11) | 0.538 |
| **BMI** | | | | |
| <30 kg/m² | 152 (51.0) | 38.45 (6.98) | Reference | 0.568 |
| ≥30 kg/m² | 129 (43.3) | 37.86 (8.18) | -0.59 (-2.60 to 1.43) | |
| No information | 17 (5.7) | | | |
| **Race/Skin color** | | | | |
| White | 89 (29.9) | 38.07 (7.06) | Reference | 0.989 |
| Nonwhite | 209 (70.1) | 38.06 (7.93) | -0.02 (-2.21 to 2.18) | |
| **Marital status** | | | | |
| With partner | 144 (48.3) | 38.20 (7.94) | Reference | 0.800 |
| Without partner | 154 (51.7) | 37.94 (7.46) | -0.26 (-2.24 to 1.73) | |
| **Professional activity** | | | | |
| No | 148 (49.7) | 39.50 (7.86) | Reference | **0.005** |
| Yes | 154 (50.3) | 36.67 (7.26) | -2.83 (-4.78 to -0.88) | |
| **Systemic Arterial Hypertension** | | | | |
| No | 166 (55.7) | 37.81 (7.47) | Reference | 0.550 |
| Yes | 132 (44.3) | 38.42 (7.98) | 0.61 (-1.40 to 2.62) | |
| **Diabetes** | | | | |
| No | 255 (85.6) | 37.80 (7.15) | Reference | 0.190 |
| Yes | 43 (14.4) | 39.72 (10.42) | 1.92 (-0.96 to 4.79) | |
| **Clinical staging** | | | | |
| Initial (<IIB) | 153 (51.3) | 37.50 (8.14) | Reference | 0.283 |
| Advanced (≥IIB) | 145 (48.7) | 38.58 (7.23) | 1.08 (-0.90 to 3.06) | |
| **Neoadjuvant treatment** | | | | |
| No | 121 (41.9) | 36.95 (7.91) | Reference | 0.104 |
| Yes | 173 (58.1) | 38.66 (7.51) | 1.71 (-0.35 to 3.78) | |
| **Neoadjuvant Chemotherapy** | | | | |
| No | 125 (41.9) | 37.35 (8.31) | Reference | 0.286 |
| Yes | 173 (58.1) | 38.47 (7.29) | 1.12 (-0.94 to 3.17) | |
| **Neoadjuvant Hormonotherapy** | | | | |
| No | 187 (62.8) | 37.19 (7.68) | Reference | **0.034** |
| Yes | 111 (37.2) | 39.35 (7.53) | 2.16 (0.16 a 4.16) | |
| **Neoadjuvant Target Therapy** | | | | |
| No | 255 (85.6) | 38.30 (7.95) | Reference | 0.289 |
| Yes | 43 (14.4) | 36.87 (6.10) | -1.43 (-4.08 to 1.22) | |
| **Type of surgery** | | | | |
| Segmentectomy | 128 (43.0) | 37.43 (7.63) | Reference | 0.306 |
| Mastectomy | 170 (57.0) | 38.48 (7.71) | 1.05 (-0.97 to 3.07) | |
| **Axillary approach** | | | | |
| Axillary lymphadenectomy | 140 (47.0) | 39.30 (7.62) | Reference | **0.010** |
| Sentinel lymph node biopsy | 158 (53.0) | 36.71 (7.55) | -2.59 (-4.54 to -0.63) | |
| **Breast and armpit surgery** | | | | |
| Segmentectomy + SLB | 75 (32.1) | 36.75 (7.65) | Reference* | |
| Segmentectomy +AL | 18 (7.7) | 40.28 (7.04) | 3.53 (-0.35 to 7.41) | **0.075** |
| Mastectomy + AL | 104 (44.4) | 39.13 (7.73) | 2.39 (0.15 to 4.63) | **0.037** |
| Mastectomy + SLB | 37 (15.8) | 36.65 (7.44) | -0.10 (-3.06 to 2.87) | 0.948 |
| **Intervention group** | | | | |
| Free ROM Livre | 157 (52.7) | 38.01 (8.36) | 0.12 (-1.87 to 2.10) | 0.908 |
| Restricted ROM | 141 (47.3) | 38.13 (6.90) | | |

SD: standard deviation; BMI: body mass index; SLB: sentinel lymph node biopsy; AL: axillary lymphadenectomy; ROM: range of motion. †Comparison between mean kinesiophobia scores. *Generalized linear model.

**Table 2.** Distribution of patients' perceptions concerning surgical wound complications and functionality during exercise performance and kinesiophobia impacts.

| Characteristics | Total=234 n (%) | Kinesiophobia | | p-value† |
|---|---|---|---|---|
| | | mean score (SD) | β (95%CI) | |
| **Pain** | | | | |
| No | 49 (20.9) | 35.12 (6.05) | Reference | **0.019** |
| Yes | 120 (51.3) | 38.05 (7.71) | 2.93 (0.49 to 5.36) | |
| No information | 65 (27.8) | | | |
| **Discomfort** | | | | |
| No | 23 (9.8) | 33.96 (5.65) | Reference | **0.023** |
| Yes | 146 (62.4) | 37.71 (7.50) | 3.76 (0.53 to 6.98) | |
| No information | 65 (27.8) | | | |
| **Difficulty** | | | | |
| No | 51 (21.8) | 34.20 (6.77) | Reference | **<0.001** |
| Yes | 116 (79.6) | 38.60 (7.29) | 4.40 (2.04 to 6.77) | |
| No information | 67 (28.6) | | | |
| **Fear** | | | | |
| No | 59 (25.2) | 36.24 (6.79) | Reference | 0.214 |
| Yes | 110 (47.0) | 37.72 (7.65) | 1.48 (-0.86 to 3.82) | |
| No information | 65 (27.8) | | | |
| **Insecurity** | | | | |
| No | 61 (26.1) | 35.64 (6.57) | Reference | **0.038** |
| Yes | 108 (46.2) | 38.08 (7.68) | 2.44 (0.13 to 4.75) | |
| No information | 65 (27.8) | | | |
| **Seroma** | | | | |
| No | 166 (70.9) | 38.22 (7.66) | Reference | 0.569 |
| Yes | 67 (28.6) | 37.58 (7.76) | -0.63 (-2.83 to 1.56) | |
| No information | 1 (0.4) | | | |
| **Infection** | | | | |
| No | 225(96.2) | 38.04 (7.52) | Reference | 0.915 |
| Yes | 8 (3.4) | 37.75 (12.09) | -0.29 (-5.75 to 5.16) | |
| No information | 1 (0.4) | | | |
| **Hematoma** | | | | |
| No | 228 (97.4) | 38.02 (7.65) | Reference | 0.822 |
| Yes | 5 (2.1) | 38.80 (9.98) | 0.78 (-6.07 to 7.64) | |
| No information | 1 (0.4) | | | |
| **Dehiscence** | | | | |
| No | 218 (93.2) | 38.05 (7.75) | Reference | 0.931 |
| Yes | 15 (6.4) | 37.87 (6.68) | -0.18 (-4.23 to 3.87) | |
| No information | 1 (0.4) | | | |
| **Necrosis** | | | | |
| No | 149 (63.7) | 37.58 (7.37) | Reference | 0.234 |
| Yes | 84 (35.9) | 38.83 (8.18) | 1.25 (-0.81 to 3.31) | |
| No information | 1 (0.4) | | | |
| **Bruising** | | | | |
| No | 215 (91.9) | 38.01 (7.78) | Reference | 0.889 |
| Yes | 18 (7.7) | 38.28 (6.54) | 0.26 (-3.46 to 3.99) | |
| No information | 1 (0.4) | | | |
| **Any complication** | | | | |
| No | 90 (38.6) | 37.43 (7.30) | Reference | 0.344 |
| Yes | 143 (61.1) | 38.41 (7.92) | 0.98 (-1.06 to 3.02) | |
| No information | 1 (0.4) | | | |
| **Worse functionality (DASH)** | | | | |
| No | 132 (56.4) | 36.39 (7.64) | Reference | **<0.001** |
| Yes | 102 (43.6) | 40.24 (7.21) | 3.85 (1.91 to 5.79) | |

†Comparison between mean kinesiophobia scores.
DASH: Disabilities of the Arm, Shoulder, and Hand questionnaire.

**Table 3.** Factors associated with kinesiophobia, final model.

| | Kinesiophobia β (95%CI) | p-value |
|---|---|---|
| **Functionality (DASH)** | 3.19 (0.93 to 5.45) | **0.006** |
| **Professional activity** | -2.45 (-4.58 to -0.33) | **0.024** |
| **Difficulty in performing the exercises** | 2.95 (0.30 to 5.41) | **0.019** |

DASH: Disabilities of the Arm, Shoulder, and Hand questionnaire.

back pain generates fear of exercising, leading to functionality deficits[30]. In the present study, an association between kinesiophobia and functionality and pain was also identified, although pain was not an independent factor (2.93; 95%CI 0.49 to 5.36).

Feysioglu et al. randomized 40 women in their postoperative breast cancer period into a group that practiced exergames (Xbox 360 Kinect®) and another who performed standard physical therapy[9]. Patients who practiced exergames exhibited reduced fear of movement, while patients in the standard exercise group displayed better functionality. No kinesiophobia differences were observed between the free or restricted exercise groups in the present study.

The results reported by different studies demonstrate that the fear of exercising, regardless of cause, interferes with patient functionality, requiring interventions by a multiprofessional team in order to decrease this fear, always attempting to promote osteomioarticular integrity restoration.

### Limitations and strengths

Study limitations include the non-supervision of the exercise performances, since they were executed at home. In an attempt to minimize this, the patients received an instructional booklet, in addition to the pre- and postoperative guidelines. This could avoid any doubts during the follow-up time at home and serve as motivation regarding exercise performance, facilitating intervention adherence. Another limitation comprises follow-up losses of 21.5% of the patients who missed the 30-day postoperative physiotherapy appointment and its rescheduling, making it impossible to apply the TSK questionnaire.

Study strengths include a robust sample size, evaluated by experienced professionals concerning the postoperative breast cancer period, guaranteeing the quality of the intervention. The short follow-up time avoided changes to patient routines that could have skewed the results. Exercising in both the restricted and limited exercise groups encouraged patient functionality maintenance.

## CONCLUSIONS

Surgical breast cancer patients exhibiting poorer functionality and greater difficulty performing the established exercises displayed higher kinesiophobia scores, while women who held professional activities exhibited lower kinesiophobia scores.

## AUTHORS' CONTRIBUTIONS

CGCT: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft. LOM: Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing. SSA: Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing. LCST: Conceptualization, Methodology, Supervision, Validation, Writing – review & editing. AB: Conceptualization, Methodology, Supervision, Validation, Writing – review & editing.

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