



Can mat Pilates and belly dance be effective in improving body image, self-esteem, and sexual function in patients undergoing hormonal treatment for breast cancer? A randomized clinical trial

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Abstract

The purpose of this study is to examine the effects of a 16-week exercise intervention (mat Pilates or belly dance) on body image, self-esteem and sexual function in breast cancer survivors receiving hormone therapy. Seventy-four breast cancer survivors were randomly allocated into mat Pilates, belly dance, or control group. The physical activity groups received a 16-week intervention, delivered 3 days a week, and 60 min a session. The control group received three education sessions. Data collection occurred at baseline, post-intervention, 6 and 12 months of follow-up with a questionnaire including body image (Body Image After Breast Cancer Questionnaire), self-esteem (Rosenberg Self-Esteem Scale), and sexual function (Female Sexual Function Index) measures. The belly dance group significantly improved body image on limitations scale in the short term and long term, the mat Pilates significantly improved body image on limitations only in the long term, and the control group significantly decreased body image on limitations in the long term. The belly dance group experienced reduced discomfort and pain during sexual relations in the short and long term. All groups showed a significant improvement in self-esteem, but orgasm sub-scale scores declined over time. No adverse events were found for any of the exercise intervention groups. Belly dance seem to be more effective than mat Pilates and control group in improving limitations of body image and sexual discomfort in the short term for breast cancer survivors. ClinicalTrials.gov (NCT03194997) - “Pilates and Dance to Breast Cancer Patients Undergoing Treatment”

Keywords Breast neoplasm · Physical activity · Exercise movement techniques · Body image · Sexual activity

Background

Breast cancer diagnosis and subsequent treatments may lead to significant physical and psychological changes in a woman's life (Dinapoli et al., 2021; Lovelace et al., 2019). Female breasts are a symbol of femininity, motherhood, and sexuality; therefore, mastectomy can lead to major alterations in body image (BI), self-esteem, and sexuality among breast cancer survivors (Arikan et al., 2020; Kolodziejczyk & Pawłowski, 2019; Martins Faria et al., 2021). Breast cancer survivors receiving hormone therapy may also experience menopausal symptoms such as loss of libido, vaginal dryness, decreased sexual function (Dorfman et al., 2019; Moon et al., 2017), increased body mass, and a decline in BI (Berkowitz et al., 2020).

Physical activity (PA) may decrease treatment side effects (Makluf et al., 2018) and improve breast cancer prognosis

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(Jung et al., 2019). However, few studies have investigated the effects of PA interventions on improving BI, according to systematic reviews by Lewis-Smith et al. (2018) and Fingeret et al. (2014). Another systematic review on interventions for sexual problems following breast cancer (Taylor et al., 2011) identified only two randomized clinical trials involving exercise (Berglund et al., 1994; Speck et al., 2010). Several observational studies have examined the relationship between PA and BI (Ribeiro et al., 2018), self-esteem (Awick et al., 2017; Pinto & Trunzo, 2004), and sexual function (Paiva et al., 2016) in breast cancer survivors. However, a clear consensus on whether PA improves BI has yet to be reached.

We hypothesize that mind-body forms of PA, such as mat Pilates and belly dance (Ruddy et al., 2017), might be viewed as a more feminine and attractive option for breast cancer survivors, particularly for addressing issues related to BI, self-esteem, and sexual function. We have previously conducted a pilot study investigating the effects of a 12-week belly dance intervention for breast cancer survivors, and positive results were found for BI and sexual function (Boing et al., 2017; Carminatti et al., 2019). A pilot study of a 12-week mat Pilates intervention also demonstrated improvements in BI, although this pilot trial did not include a control group (Stan et al., 2012). To our knowledge, these are the only studies investigating mat Pilates and belly dance on the effects on BI, sexual function, and self-esteem.

The aim of this study was to examine the effects of a 16-week exercise intervention (mat Pilates or belly dance) on BI, self-esteem, and sexual function in breast cancer survivors receiving hormone therapy, at 16 weeks (short term), 6 months (long term), and 12 months (long term).

Methods

Trial design and participants

The MoveMama study, which was previously described elsewhere (Boing et al., 2020), is a single-center, prospective, three-arm randomized clinical trial and registered at ClinicalTrials.gov (NCT03194997) by the name of “Pilates and Dance to Breast Cancer Patients Undergoing Treatment.” Briefly, the participants were recruited from the Oncology Research Centre (CEPON) between 2015 and 2017. Eligible participants of this trial were women diagnosed with breast cancer receiving hormone therapy, living in Florianopolis or Sao Jose (two cities in Southern Brazil), aged 18 years or older, breast cancer clinical stage 0 to III, and received medical clearance to take part in PA. Participants were excluded if they had significant physical or neurological limitations, such as Parkinson’s disease, Alzheimer’s disease, or the use of a wheelchair. Randomization was realized through a

website (<http://www.randomization.com>) which randomizes each subject to a single treatment by using the method of randomly permuted blocks and provided the allocation of women in the three groups (mat Pilates, belly dance, and control group). Randomization was performed by two researchers, and it was stratified by age (below 60 years old and above 60 years old).

Sample size

The sample size was calculated using the 5% of significance level, power test of 80%, and median effect size (f^2) of 0.22 (Oh-Young et al., 2018). Considering the three arms of the study and the four moments of data collection, and after including a sample loss margin of 30%, a sample of 17 patients was requested for each group.

Physical exercise interventions

The 16-week intervention of mat Pilates and belly dance (3× per week, 60-min class) was delivered at CEPON by a physiotherapist that is a Pilates Method certified instructor, and an exercise science professional with previous experience in dance. Each class was organized into (i) warm-up and stretching, (ii) main part of the class, and (iii) cool down. Detailed information about the intervention is presented in the study protocol (Boing et al., 2020).

Briefly, for the mat Pilates intervention, most exercises were performed in the supine position, aiming to avoid the impact of the floor on the joints (Fig. 1). Each exercise focused on breathing, stretching the upper and lower limbs, mobility of the upper limb, and strengthening of the upper and lower limbs and core. The intensity was progressively increased adding TheraBand® and a toning ball and a weight of 1 kg to the spinal rotation exercise. The belly dance intervention included activities in a circle and with partners (Fig. 1). The dance routines focused on motor coordination, rhythm, and body awareness, flexibility of the upper and lower limbs, and range of motion of the upper limbs. The intensity was increased progressively by the rhythm of the music, controlled by measuring the beats per minute (bpm) of the songs, increasing from 80 to 150 bpm.

Control group

During the 16-week of intervention, the control group received an invitation to three educational sessions that addressed a different topic at each session: the first meeting aimed at describing stretching exercises to be performed at home (June 2018); the second meeting approached advice on how to deal with self-esteem and BI after breast cancer (August 2018), and the last meeting focused on behavior

Fig. 1 SEQ figure * ARABIC 1. **a** Mat Pilates exercise intervention. **b** Belly dance exercise intervention. Note. Photo courtesy of the MoveMama study. Used with permission



changes regarding the prevention of lymphedema (September 2018).

During baseline, women from mat Pilates, belly dance, and control received a free T-shirt from the MoveMama study. At the end of the 16-week intervention, women from all trial arms were invited to continue practicing PA in a social program for breast cancer survivors at the Santa Catarina State University (UDESC). They also received a booklet containing recommendations for PA and information about breast cancer.

Assessment of participant characteristics

Participants' sociodemographic and clinical information were assessed at baseline by a questionnaire administered by three researchers (LB, FS, and TBF), during an interview. Information assessed included age, marital status, body mass index (BMI), type of surgery and axillary assessment, modality of hormone therapy, and previously clinical therapy.

Main outcomes

BI was evaluated by the Body Image After Breast Cancer Questionnaire (BIBCQ) (Baxter et al., 2006), which has been validated in Brazil (Gonçalves et al., 2014). It is a specific instrument used to verify the perception of BI after breast cancer diagnosis and treatment. The Brazilian version of BIBCQ is composed of 44 questions divided into six scales (vulnerability, body stigma, limitations, body concerns, transparency, and arm concerns). A higher score indicates a poorer perception of BI.

The Rosenberg Self-Esteem Scale (M. Rosenberg, 1965), which has been validated in Brazil (Dini et al., 2004) and for the cancer adult population (Curbow &

Somerfield, 1991), was used to assess the self-esteem. It consists of 10 items that evaluate global self-esteem. The final score of global self-esteem ranges from zero to 40, with higher scores denoting higher self-esteem.

Sexual function was measured by the Female Sexual Function Index (FSFI), which has been validated in Brazil (Thiel et al., 2008) and in breast cancer women (Bartula & Sherman, 2015). It is a brief multidimensional scale consisted of 19 questions, divided into six subscales (desire, arousal, lubrication, orgasm, satisfaction, and pain). The final score goes from 2 to 36, and a higher score indicates a better sexual function, and scores less than 26 determine the risk of sexual dysfunction. It has been indicated as a good quality scale to identify sexual dysfunction among breast cancer survivors (Bartula & Sherman, 2013). For the sexual function final score, we included only participants who were sexually active during the last 4 weeks, as suggested by the literature (Brotto, 2009; Meyer-Bahlburg & Dolezal, 2007); for the desire and satisfaction scales, women were included even if they were not sexually active.

Procedures

Data collection occurred in four moments, at baseline (T0), post-intervention (T1), 6 months (T2), and 12 months (T3), and it was conducted at the facilities of UDESC. The study was approved by the Institutional Review Board (IRB) (CEPSH) of UDESC, reference number 2.252.288, and by the IRB of CEPON (CEP), reference number 2.319.138. All patients who agreed to participate in the study had signed the informed consent form. Permission to use the patient's photo was also obtained during the study, and the authorization to use the image was signed by each patient.

Statistical methods

The comparison of categorical outcomes between groups (mat Pilates, belly dance, and control) at baseline was assessed by the X^2 test or Fisher's exact test (when $n < 5$). After performing the normality test with the Shapiro–Wilk test considering the three groups, one-way ANOVA was used to compare age and to compare time since surgery between the three groups.

The generalized estimated equation (GEE) with the least significant difference (LSD) post hoc test was used for analyzing the effect of interaction between groups versus time and the individual effect of time and group on self-esteem, BI, and sexual function. In the study protocol (Boing et al., 2020), we defined that we would use two-way ANOVA for repeated measures. However, considering the loss to follow-up, the GEE was more suitable for analyzing the available data. An intention-to-treat analysis was used and included all participants who completed the baseline and post-intervention data collection, regardless of adherence to the exercise intervention. The analysis on BI and self-esteem was controlled by the type of surgery (mastectomy with reconstruction, mastectomy without reconstruction, and breast-conserving surgery), and the analysis on sexual function was controlled by marital status (with or without a partner).

All the analysis was performed using the IBM SPSS Statistics version 20.0 software (IBM, Armonk, NY, USA). The level of significance was set at $p < 0.05$.

Results

Participant flow

Out of 662 potentially eligible women with breast cancer, 74 of the patients from CEPON were randomized after agreeing to participate in the MoveMama study. Only 52 participants (70%) completed the 16-week intervention (Fig. 2).

Baseline data

The baseline characteristics according to randomized groups, regardless of adherence to protocol adherence, are presented as Supplementary Material. The different groups appeared reasonably balanced at baseline.

Main outcomes

The interaction and main effects of the groups (mat Pilates, belly dance, and control) and time on BI and self-esteem are presented in Table 1. The model showed an effect on the group versus time interaction on limitations, with an improvement for the Pilates group from baseline to 12

months ($p = 0.014$), and for the belly dance group from baseline to the post-intervention ($p = 0.004$), and baseline to the 12 months ($p = 0.022$), and a worsening for the control group between baseline to the 12 months ($p = 0.045$). A group effect was found for arm concerns, between Pilates and dance ($p = 0.004$), with better scores for the Pilates group since baseline. The model showed a time effect on global self-esteem, with an improvement for all women (mat Pilates, belly dance, and control) from baseline to 12 months ($p = 0.050$).

The modality of surgery was significant in the model for the vulnerability ($p = 0.021$), body stigma ($p = 0.016$), and transparency ($p < 0.001$), with the better scores among women who were submitted to breast-conserving surgery.

The interaction and main effects of the groups (mat Pilates, belly dance, and control) and time on sexual function are presented in Table 2. The model showed an effect of time on orgasm, with a decrease for women from all groups (mat Pilates, belly dance, and control), between baseline and post-intervention ($p = 0.021$), and baseline and 6 months ($p < 0.001$). Also, the model showed an interaction effect between group versus time for pain/discomfort, with an improvement for the belly dance group from baseline to post-intervention ($p = 0.001$), from baseline to 6 months ($p < 0.001$), and from baseline to 12 months ($p = 0.005$).

Discussion

The aim of this study was to examine the effects of a 16-week exercise intervention (mat Pilates or belly dance) on BI, self-esteem, and sexual function in breast cancer survivors receiving hormone therapy, at 16 weeks (short term), 6 months (long term), and 12 months (long term). We found limited evidence of effects on BI. An improvement in the limitations scale for mat Pilates in the long term, between baseline and 12 months follow-up, and for the belly dance group in the short term, between baseline and post-intervention, and long term, between baseline and 12 months follow-up, were noted, with worsening scores for the control group in the long term, between baseline and 12 months follow-up. Group differences between mat Pilates and belly dance were found in the BI of arm concerns scores. Self-esteem improved significantly over time for all women in the study. With regards to sexual function, an improvement on pain/discomfort was observed only for the belly dance arm in the short term, between baseline and post-intervention, and in the long term, between baseline and follow-up of 6 and 12 months. A worsening over time for orgasm was noted for all participants. Because BI and sexual function concerns are common among breast cancer survivors (Jahromi et al., 2022), these findings may help oncology health specialists

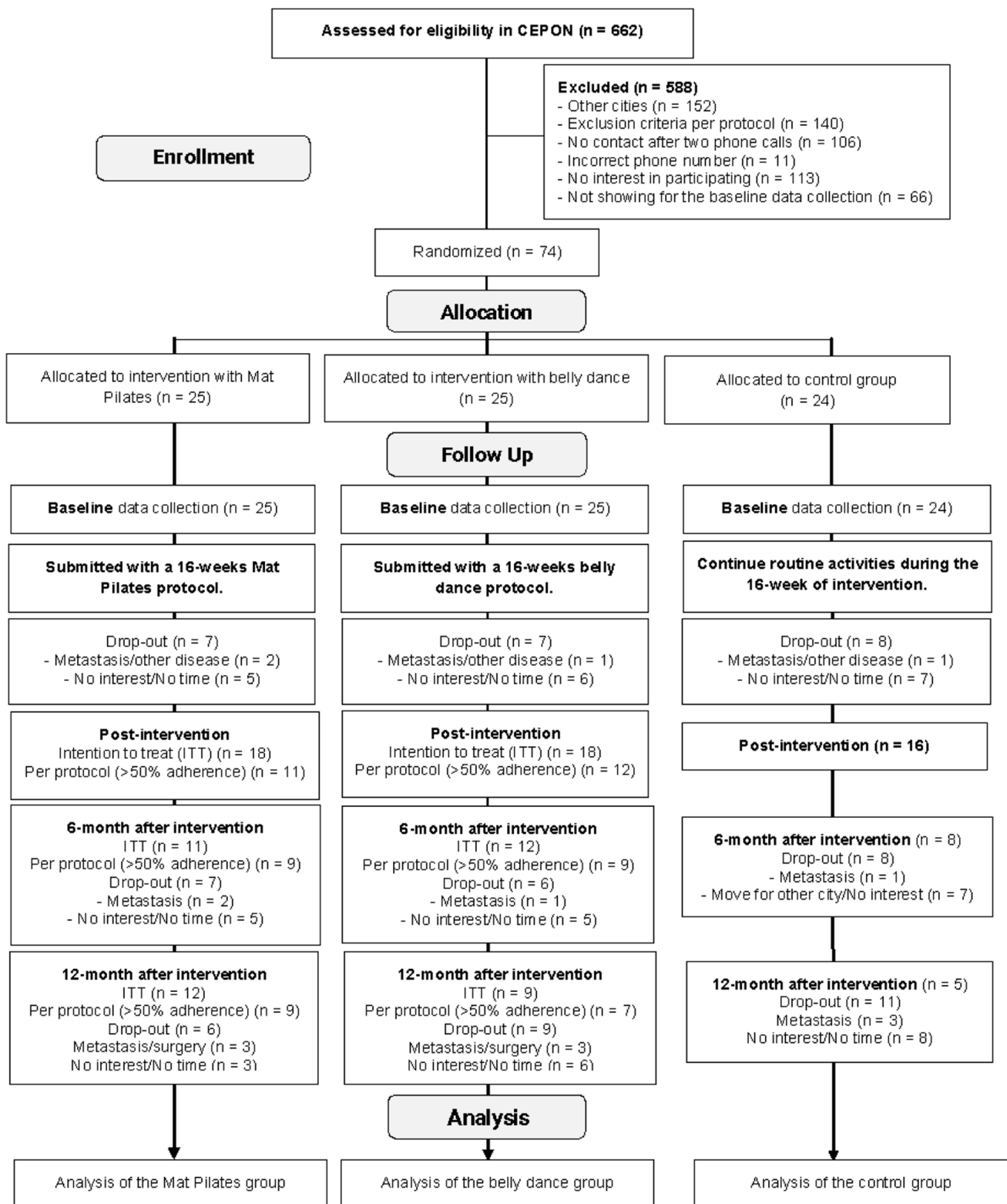


Fig. 2 Flow diagram of the study

Table 1 Effects and interaction between mat Pilates, belly dance and control group on body image and self-esteem by intent to treat analysis expressed by mean (std error).

	Groups (<i>n</i> = 52)					Group <i>p</i> value	Time <i>p</i> value	Interaction <i>p</i> value
		Baseline	Post-intervention	6 months	12 months			
Body image								
Vulnerability [#]						0.595	0.662	0.245
	Pilates	17.6 (1.4)	17.3 (1.8)	19.0 (2.3)	17.7 (2.5)			
	Dance	21.0 (1.9)	19.2 (1.5)	19.6 (1.4)	15.9 (1.7)			
	Control	19.4 (1.3)	19.1 (1.6)	19.7 (2.4)	21.1 (3.1)			
	Total	19.3 (1.0)	18.5 (1.0)	19.4 (1.3)	18.2 (1.5)			
Body stigma [#]						0.769	0.538	0.594
	Pilates	26.0 (2.4)	24.4 (2.8)	29.7 (3.9)	27.6 (3.6)			
	Dance	30.3 (3.2)	29.1 (2.5)	29.7 (3.2)	27.0 (4.6)			
	Control	32.1 (2.7)	26.2 (2.6)	28.4 (3.2)	28.3 (4.7)			
	Total	29.5 (1.8)	26.6 (1.6)	29.3 (2.1)	27.7 (2.6)			
Limitations						0.444	0.053	0.001
	Pilates	13.0 (1.0) ^a	12.0 (1.3)	12.4 (1.3)	10.6 (0.8) ^b			
	Dance	15.6 (1.2) ^a	11.6 (0.9) ^b	14.0 (1.0)	12.2 (1.6) ^b			
	Control	12.1 (1.1) ^a	11.1 (1.1)	13.0 (1.2)	14.3 (0.9) ^b			
	Total	13.5 (0.6)	11.6 (0.7)	13.0 (0.7)	12.3 (0.7)			
Body concerns						0.498	0.060	0.796
	Pilates	17.0 (1.1)	13.5 (1.0)	16.0 (1.7)	14.0 (1.5)			
	Dance	16.0 (1.4)	15.6 (1.6)	16.4 (1.3)	14.0 (1.8)			
	Control	18.4 (1.3)	17.3 (1.4)	16.2 (2.4)	15.0 (2.6)			
	Total	17.0 (0.8)	15.4 (0.8)	16.2 (1.0)	14.3 (1.3)			
Transparency [#]						0.841	0.490	0.752
	Pilates	10.0 (1.2)	9.5 (1.3)	10.0 (1.5)	8.2 (1.0)			
	Dance	11.0 (0.9)	9.7 (0.8)	9.5 (1.1)	9.5 (1.5)			
	Control	11.4 (1.5)	9.3 (1.0)	8.4 (1.2)	9.7 (1.9)			
	Total	11.0 (0.8)	9.5 (0.6)	9.3 (0.8)	9.2 (0.9)			
Arm concerns						0.011	0.267	0.124
	Pilates ^a	5.0 (0.4)	5.8 (0.5)	5.3 (0.4)	4.7 (0.4)			
	Dance ^b	7.3 (0.7)	5.7 (0.6)	8.0 (0.8)	6.2 (0.6)			
	Control	7.0 (0.7)	6.0 (0.5)	5.6 (0.8)	6.0 (1.0)			
	Total	6.3 (0.4)	5.7 (0.3)	6.2 (0.4)	5.7 (0.4)			
Self-esteem						0.771	0.010	0.484
	Pilates	30.2 (1.1)	32.6 (1.2)	29.2 (1.6)	33.0 (1.3)			
	Dance	32.0 (1.4)	33.0 (0.9)	30.2 (1.6)	34.0 (1.9)			
	Control	30.1 (1.7)	32.0 (1.1)	32.4 (1.8)	32.0 (2.2)			
	Total	31.0 (0.8) ^a	32.5 (0.7)	30.6 (1.0)	33.0 (1.1) ^b			

Generalized estimating equation (GEE) and least significance difference (LSD)

Significant values are presented in bold ($p \leq 0.05$)

^(a) ^(b) Represent the difference found in LSD. Values with (a) are different from (b), (a) \neq (b)

Controlled by surgery type (mastectomy with reconstruction, mastectomy without reconstruction, and breast-conserving surgery)

[#]Surgery type was significant in the model

tailor the delivery of PA interventions to address the specific needs of breast cancer survivors.

This randomized controlled trial showed that a 16-week intervention with belly dance improves the limitations scale of BI at short term (baseline versus post-intervention), and

in the long term (baseline versus 12 months follow-up), improvements were found for belly dance and Pilates group, with a worsening for the control group. The limitations scale refers to feelings about competence and ability, including questions about energy level, feeling tired or sleepy during

Table 2 Effects and interaction between mat Pilates, belly dance, and control group on sexual function by intent to treat analysis expressed by mean (std error)

Groups (<i>n</i> = 52)						Group <i>p</i> value	Time <i>p</i> value	Interaction <i>p</i> value
		Baseline	Post-intervention	6 months	12 months			
Sexual function								
Desire						0.794	0.127	0.060
	Pilates	4.8 (0.2)	4.2 (0.3)	4.4 (0.3)	4.4 (0.3)			
	Dance	4.9 (0.2)	4.4 (0.3)	4.0 (0.4)	4.6 (0.4)			
	Control	4.4 (0.3)	5.0 (0.3)	4.2 (0.4)	3.3 (0.4)			
	Total	4.7 (0.1)	4.5 (0.1)	4.2 (0.2)	4.1 (0.20)			
Arousal						0.798	0.714	0.909
	Pilates	3.5 (0.4)	3.4 (0.3)	3.6 (0.5)	3.2 (0.4)			
	Dance	3.6 (0.4)	3.6 (0.2)	2.7 (0.5)	2.9 (0.2)			
	Control	3.5 (0.3)	3.1 (0.5)	3.2 (0.9)	3.2 (0.6)			
	Total	3.5 (0.2)	3.3 (0.2)	3.1 (0.3)	3.1 (0.2)			
Lubrication						0.631	0.133	0.182
	Pilates	4.1 (0.3)	3.7 (0.2)	3.6 (0.1)	4.0 (0.1)			
	Dance	4.0 (0.2)	3.9 (0.4)	3.4 (0.1)	3.3 (0.1)			
	Control	4.0 (0.2)	3.4 (0.5)	4.0 (0.2)	3.8 (0.2)			
	Total	4.0 (0.1)	3.6 (0.2)	3.6 (0.1)	3.7 (0.1)			
Orgasm						0.764	0.003	0.607
	Pilates	3.8 (0.3)	3.3 (0.2)	3.2 (0.3)	3.6 (0.2)			
	Dance	4.0 (0.3)	3.3 (0.3)	2.8 (0.2)	3.1 (0.3)			
	Control	3.8 (0.3)	2.9 (0.4)	3.1 (0.3)	3.6 (0.4)			
	Total	3.9 (0.1) ^a	3.2 (0.2) ^b	3.1 (0.1) ^b	3.4 (0.1)			
Satisfaction						0.734	0.249	0.889
	Pilates	2.2 (0.2)	2.0 (0.2)	2.0 (0.2)	2.2 (0.2)			
	Dance	2.5 (0.2)	2.1 (0.1)	2.1 (0.1)	2.1 (0.1)			
	Control	2.6 (0.3)	2.0 (0.2)	2.0 (0.3)	2.6 (0.6)			
	Total	2.4 (0.1)	2.1 (0.1)	2.0 (0.1)	2.3 (0.2)			
Pain/Discomfort						0.754	0.113	0.038
	Pilates	4.9 (0.4)	5.2 (0.2)	4.6 (0.5)	4.6 (0.5)			
	Dance	3.5 (0.4) ^a	5.3 (0.3) ^b	5.2 (0.2) ^b	5.3 (0.5) ^b			
	Control	4.5 (0.5)	3.6 (0.6)	5.0 (0.3)	4.9 (0.6)			
	Total	4.2 (0.2)	4.6 (0.2)	4.9 (0.2)	4.9 (0.3)			
Final score						0.842	0.716	0.303
	Pilates	22.5 (2.0)	20.5 (1.2)	21.2 (1.2)	22.3 (0.9)			
	Dance	21.4 (2.0)	21.8 (1.3)	20.2 (1.0)	20.0 (0.9)			
	Control	22.9 (1.6)	20.0 (1.7)	21.4 (2.4)	21.4 (1.7)			
	Total	22.3 (1.1)	20.7 (0.8)	20.9 (0.9)	21.2 (0.6)			

Generalized estimating equation (GEE) and least significance difference (LSD)

Significant values are presented in bold ($p \leq 0.05$)^(a) ^(b) Represent the difference found in LSD. Values with (a) are different from (b), (a) \neq (b)

Controlled by marital status

Subscribed letters representing significant difference from post hoc LSD ($p < 0.05$)

the day, competence about participation in normal activities, feeling of normality, and sensation of body capacity (Baxter et al., 2006). Regardless of receiving a mastectomy or breast-conserving surgery, belly dance had a positive short-term effect, with women in these groups achieving a sense

of normality, ability, and competence in their own body after the 16 weeks of intervention. The present findings extend previous pilot studies with the improvement of BI after belly dance (Boing et al., 2017; Carminatti et al., 2019). For the long-term effects of mat Pilates and belly dance, and the

worsen scores for the control group, it is important to highlight that both groups were motivated to keep the physical activity after the intervention. However, during follow-up, women randomized to the mat Pilates group reported 94 (± 62) minutes (min) at 12 months, the dance group reported 84 (± 87) min at 12 months, and the control group reported 48 (± 35) min at 12 months (data not shown in the tables).

The mat Pilates and belly dance interventions were delivered in groups, which can promote social and community support, and are also more accessible than individual personalized interventions (Ruddy et al., 2017), making it an interesting option for oncology environments in low- and middle-income countries. It is important to note that belly dance classes were not delivered in a setting with a mirror, as it is normal in dance classes (Ruddy et al., 2017), and this must be taken into consideration when applying these activities. No adverse events occurred during the intervention. The interventions were carried out in an auditorium of the Oncology Research Centre, which is a public hospital in Brazil, demonstrating that this type of intervention is feasible, safe, and effective and should be implemented in an oncology environment.

The mat Pilates group had better scores on concerns about BI of the arm when compared to the belly dance group. However, this difference was noted at baseline, and not on post-intervention. It is noted that belly dance women had an improvement in the post-intervention reaching similar values as Pilate's women. The arm concerns scale refers to worries about arm symptoms and appearance, particularly about the feeling that the arm is normal, satisfaction with the appearance of the arm, and pain and swelling of the arm (Baxter et al., 2006). Our hypothesis was that Pilates would improve concerns about BI of the arm, as when compared with belly dance, the mat Pilates intervention explored more exercises focusing on the strength of the upper limb, using TheraBand®, magic circle and toning ball, and a weight of 1 kg. Though belly dance classes also explored arm movements during the dance sequence such as abduction, flexion, and extension of the shoulder, and these movements were accompanied by music in dynamic sequences using a veil and a tambourine, which may have been important for women to feel safer and more satisfied with their arm in relation to BI. Belly dance and mat Pilates can be recommended for breast cancer survivors with greater arm symptoms and concerns regarding arm-related BI.

Although no significant effect of the intervention was found for vulnerability, body stigma, and transparency of BI scales, the model identified a significant effect for surgery type, with better scores for breast-conserving surgery compared to mastectomy (without or without breast reconstruction). These findings are in line with the literature, as it reflects the worst BI for women submitted to mastectomy (Archangelo et al., 2019; Fingeret et al., 2014; Kowalczyk

et al., 2019; S. M. Rosenberg et al., 2020; Zehra et al., 2020). Thus, it is recommended that the oncology health community provides specific and better care to mastectomized women, as they are at a higher risk of presenting BI issues (Jahromi et al., 2022).

We noticed an improvement in the self-esteem from baseline to 12 months for the entire study sample, regardless of the surgery modality. In fact, all women demonstrated great self-esteem during all periods of study. This improvement for all samples may be due to the fact that being part of a study can change the participant's health and social behaviors, even in the control group (Becker et al., 2003). The concept of self-esteem applied in our study is Rosenberg's global self-esteem (M. Rosenberg, 1965), which identifies someone's positive or negative attitude toward themselves as a whole (Morris Rosenberg et al., 1995). It is perceived that an individual's feelings about himself may arise from interaction with others, and be influenced by internal and external sources, as a social and environmental process. Perhaps, the perception of belonging to a group, looking forward to data collection, and sharing their experience with researchers and other breast cancer survivors during the intervention and educational sessions may be a reason for the improvement in self-esteem over time. It is expected that after surgery, breast cancer women will demonstrate an improvement in the quality of life over time (Biparva et al., 2022), and this may also have affected our findings, as our sample was approximately 2 years and 5 months after surgery.

This trial showed a significant improvement between baseline, post-intervention, and 6 and 12 months of follow-up in sexual pain/discomfort for the belly dance group. Belly dance, as an exclusive modality of dance for women, is described as a natural expression of femininity, as it promotes sensuality, self-empowerment, and feminine movements (Carminatti et al., 2019). Belly dance classes provide the participants with the opportunity of artistic freedom to create their own pattern of movement based on the belly dance technique, while respecting their own body awareness and allowing the expression of feelings, as described in the study protocol (Boing et al., 2020). In addition, belly dance movements are focused on the abdomen and hips (Tournillon & Siegler, 2021), and many specific hip movements from this technique were stimulated during the sessions, such as loosening of hips, pendulum, side hit, undulations, round, and shimmy which can be stimuli for these women to perceive more comfortable positions during sexual activity. The use of costumes, dancing with the veil, and tambourine during the classes may have stimulated sexuality and self-confidence in these women as well. It can be concluded that belly dance can be an option of PA indicated for breast cancer women who perceive discomfort during sexual activity.

In contrast, our study found that all participants reported a decline in orgasm over time, regardless of marital status.

Similarly, the study of Archangelo et al. (2019) demonstrated a female orgasmic disorder in women with breast cancer undergoing treatment, with an association for those submitted to mastectomy. It is known that female orgasm is a complex topic, as it can occur from different stimuli of the clitoris or vagina during sexual intercourse. Some women require different stimulation, and some women never reach orgasm during sexual intercourse (Arias-Castillo et al., 2022; Kontula & Miettinen, 2016). A qualitative study identifies that other factors may affect the ability to achieve orgasms, such as relational obstacles, anxiety, shame, lack of knowledge, embarrassment, lack of concentration, and lack of privacy (Nekoolaltak et al., 2017). In addition, our findings may be due to the relationship between orgasm and lubrication (González et al., 2006), as our sample did not present any improvement in lubrication, which may be influenced by the use of hormone therapy.

Consistent with other investigations (Kedde et al., 2013; Kowalczyk et al., 2019), 87% of the sample reported sexual dysfunction at the study baseline. It is expected that breast cancer survivors present dissatisfaction with their sexual life during the treatment time (Cobo-Cuenca et al., 2019; Yan et al., 2020). It is noted that all women from our study were receiving hormone therapy, being tamoxifen (42%) or aromatase inhibitors (58%), which can be associated with menopausal symptoms and result in vaginal dryness, dyspareunia, and loss of libido (Dorfman et al., 2019; Pegorare et al., 2017). Some studies even evidence severe symptoms of sexual dysfunction in women receiving aromatase inhibitors compared to tamoxifen (Baumgart et al., 2013; Lemke et al., 2017).

Our sexual function analysis was adjusted for marital status, and no significant effects were found. However, feeling supported in a relationship and physically satisfied in sexual activity may be associated with sexual dysfunction among breast cancer survivors (Kowalczyk et al., 2019). It is recommended that interventions focusing on sexual problems experienced by breast cancer survivors should involve women and their partner and include sexual counseling or therapy (Faghani & Ghaffari, 2016).

Clinical implications

This trial provides evidence that a 16-week intervention with mat Pilates or belly dance is effective in improving the limitations scale of BI among breast cancer survivors receiving hormone therapy in the short and long term. The belly dance intervention was also effective in improving discomfort/pain during sexual relations in the short and long term. Belly dance intervention was more effective than mat Pilates intervention in promoting short-term changes in body image limitations and sexual discomfort in breast cancer survivors receiving hormone therapy. These two types of PA can be

recommended as complementary therapeutic options in the oncology setting.

Study limitations

This study presented some limitations that should be considered. The analysis of sexual function could only include sexually active women; therefore, the sample size was reduced for this finding. Other limitations are the loss to follow-up and being unable to blind participants and researchers to group allocation. The fact that our control group received three educational sessions, as the IRB of Cepon required, may have influenced the findings. However, the strengths of our study include the randomized clinical trial design with follow-up, the focus on breast cancer survivors receiving hormone therapy, the use of valid measures, and the novelty of the study, including two different PA interventions.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00737-023-01294-4>.

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Declarations

Conflict of interest The authors declare no competing interests.

References

- ABG de Souza Pegorare, Silveira, K. da R., No, A. P. S., & Barbosa, S. R. M. (2017). Assessment of female sexual function and quality of life among breast cancer survivors who underwent hormone therapy. *Revista Brasileira de Mastologia*, 27(3), 237–244. <https://doi.org/10.5327/Z2594539420170000161>
- Archangelo SCV, Sabino M, Veiga DF, Garcia EB, Ferreira LM (2019) Sexuality, depression and body image after breast reconstruction. *Clinics* 74:e883. <https://doi.org/10.6061/clinics/2019/e883>
- Arias-Castillo L, García L, García-Perdomo HA (2022) The complexity of female orgasm and ejaculation. *Arch Gynecol Obstet*. <https://doi.org/10.1007/s00404-022-06810-y>
- Arikan F, Korukcu O, Kucukcakal A, Coskun HS (2020) Determination of self-efficacy, body image and sexual adjustment of women with breast cancer. *Eur J Breast Health* 16(4):282–289. <https://doi.org/10.5152/ejbh.2020.5188>
- Awick EA, Phillips SM, Lloyd GR, McAuley E (2017) Physical activity, self-efficacy and self-esteem in breast cancer survivors: a panel model. *Psychosoc Oncol* 26(10):1625–1631. <https://doi.org/10.1002/pon.4180>
- Bartula I, Sherman KA (2013) Screening for sexual dysfunction in women diagnosed with breast cancer: systematic review and recommendations. *Breast Cancer Res Treat* 141(2):173–185. <https://doi.org/10.1007/s10549-013-2685-9>
- Bartula I, Sherman KA (2015) The Female Sexual Functioning Index (FSFI): evaluation of acceptability, reliability, and validity in women with breast cancer. *Support Cancer Ther* 23(9):2633–2641. <https://doi.org/10.1007/s00520-015-2623-y>

- Baumgart J, Nilsson K, Evers AS, Kallak TK, Poromaa IS (2013) Sexual dysfunction in women on adjuvant endocrine therapy after breast cancer. *Menopause* 20(2):162–168. <https://doi.org/10.1097/GME.0b013e31826560da>
- Baxter NN, Goodwin PJ, Mcleod RS, Dion R, Devins G, Bombardier C (2006) reliability and validity of the body image after breast cancer questionnaire. *J Breast Cancer* 12(3):221–232. <https://doi.org/10.1111/j.1075-122X.2006.00246.x>
- Becker H, Roberts G, Voelmeck W (2003) Explanations for improvement in both experimental and control groups. *West J Nurs Res* 25(6):746–755
- Berglund G, Bolund C, Gustafsson U-L, Sjöden P-O (1994) A randomized study of a rehabilitation program for cancer patients: the ‘starting again’ group. *Psychosoc Oncol* 3(2):109–120. <https://doi.org/10.1002/pon.2960032025>
- Berkowitz MJ, Thompson CK, Zibecchi LT, Lee MK, Streja E, Berkowitz JS, Wenziger CM, Baker JL, DiNome ML, Attai DJ (2020) How patients experience endocrine therapy for breast cancer: an online survey of side effects, adherence, and medical team support. *J Cancer Surviv*. <https://doi.org/10.1007/s11764-020-00908-5>
- Boing L, Baptista F, Pereira GS, Sperandio FF, Moratelli J, Cardoso AA, Borgatto AF, de Azevedo Guimarães AC (2017) Benefits of belly dance on quality of life, fatigue, and depressive symptoms in women with breast cancer – a pilot study of a non-randomised clinical trial. *J Bodyw Mov Ther* 22(2):460–466. <https://doi.org/10.1016/j.jbmt.2017.10.003>
- Boing, L., do Bem Fretta, T., de Carvalho Souza Vieira, M., Pereira, G. S., Moratelli, J., Sperandio, F. F., Bergmann, A., Baptista, F., Dias, M., & de Azevedo Guimarães, A. C. (2020). Pilates and dance to patients with breast cancer undergoing treatment: study protocol for a randomized clinical trial – MoveMama study. *Trials*, 21(1), 35. <https://doi.org/10.1186/s13063-019-3874-6>
- Brotto L (2009) Letter to the Editor. *J Sex Marital Ther* 35(3):161–163. <https://doi.org/10.1080/00926230802716294>
- Carminatti, M, Boing L, Leite B, Sperandio FF, Korpalski T, Fretta TB, Vieira MCS, Leitao AE, Moratelli J, Fausto DY, Klen JA, Guimaraes ACA (2019) Effects of belly dancing on body image and self-esteem in women with breast cancer - pilot study. *Revista Brasileira de Medicina Do Esporte* 25(6):464–468. <https://doi.org/10.1590/1517-869220192506220067>
- Cobo-Cuenca AI, Martín-Espinosa NM, Rodríguez-Borrego MA, Carmona-Torres JM (2019) Determinants of satisfaction with life and self-esteem in women with breast cancer. *Qual Life Res* 28(2):379–387. <https://doi.org/10.1007/s1136-018-2017-y>
- Curbow B, Somerfield M (1991) Use of the Rosenberg self-esteem scale with adult cancer patients. *J Psychosoc Oncol* 9(2):113–131. https://doi.org/10.1300/J077v09n02_08
- Dinapoli L, Colloca G, Di Capua B, Valentini V (2021) Psychological aspects to consider in breast cancer diagnosis and treatment. *Curr Oncol Rep* 23(3):38. <https://doi.org/10.1007/s11912-021-01049-3>
- Dini G, Quaresma M, Ferreira L (2004) Adaptação cultural e validação da versão brasileira da escala de autoestima de Rosenberg. *Revista Da Sociedade Brasileira de Cirurgia Plastica* 19:41–52
- Dorfman CS, Arthur SS, Kimmick GG, Westbrook KW, Marcom PK, Corbett C, Edmond SN, Shelby RA (2019) Partner status moderates the relationships between sexual problems and self-efficacy for managing sexual problems and psychosocial quality-of-life for postmenopausal breast cancer survivors taking adjuvant endocrine therapy. *Menopause* 26(8):823–832. <https://doi.org/10.1097/GME.0000000000001337>
- Faghani S, Ghaffari F (2016) Effects of sexual rehabilitation using the PLISSIT model on quality of sexual life and sexual functioning in post-mastectomy breast cancer survivors. *Asian Pac J Cancer Prev* 17(11):4845–4851. <https://doi.org/10.22034/APJCP.2016.17.11.4845>
- Fingeret MC, Teo I, Epner DE (2014) Managing body image difficulties of adult cancer patients: lessons from available research. *Cancer* 120(5):633–641. <https://doi.org/10.1002/cncr.28469>
- González M, Viáfara G, Caba F, Molina T, Ortiz C (2006) Libido and orgasm in middle-aged woman. *Maturitas* 53(1):1–10. <https://doi.org/10.1016/j.maturitas.2004.07.003>
- Gonçalves CO, Tavares MCGCF, Campana ANNB, Cabello C (2014) Validation of the instrument “body image after breast cancer” in Brazil. *Motriz: Revista de Educação Física* 20(1):8–15. <https://doi.org/10.1590/S1980-65742014000100002>
- Jahromi AR, Ranjbar A, Naseripour P, Rahmanian V, Jamali S (2022) Body image and sexual function in women with breast cancer. *Sex Relatsh Ther* 1–11. <https://doi.org/10.1080/14681994.2022.2097212>
- Javan Biparva A, Raoofi S, Rafiei S, Pashazadeh Kan F, Kazerooni M, Bagheribayati F, Masoumi M, Doustmehraban M, Sanaei M, Zarabi F, Raoofi N, Beiramy Chomalu Z, Ahmadi B, Seyghalani Talab F, Sadat Hoseini B, Asadollahi E, Mir M, Deylami S, Zareei M, Ghashghaee A (2022) Global quality of life in breast cancer: systematic review and meta-analysis. *BMJ Supportive & Palliative Care*, bmjpspcare-2022-003642. <https://doi.org/10.1136/bmjpspcare-2022-003642>
- Jung AY, Behrens S, Schmidt M, Thoene K, Obi N, Hüsing A, Benner A, Steindorf K, Chang-Claude J (2019) Pre- to postdiagnosis leisure-time physical activity and prognosis in postmenopausal breast cancer survivors. *Breast Cancer Res* 21(1):117. <https://doi.org/10.1186/s13058-019-1206-0>
- Kedde H, van de Wiel HBM, Weijmar Schultz WCM, Wijzen C (2013) Sexual dysfunction in young women with breast cancer. *Support Care Cancer* 21(1):271–280. <https://doi.org/10.1007/s00520-012-1521-9>
- Kolodziejczyk A, Pawłowski T (2019) Negative body image in breast cancer patients. *Advances. Clin Exp Med* 28(8):1137–1142. <https://doi.org/10.17219/acem/103626>
- Kontula O, Miettinen A (2016) Determinants of female sexual orgasms. *Socioaffect Neurosci Psychol* 6(1):31624. <https://doi.org/10.3402/snp.v6.31624>
- Kowalczyk R, Nowosielski K, Cedrych I, Krzysztanek M, Glogowska I, Streb J, Kucharz J, Lew-Starowicz Z (2019) Factors affecting sexual function and body image of early-stage breast cancer survivors in Poland: a short-term observation. *Clin Breast Cancer* 19(1):e30–e39. <https://doi.org/10.1016/j.clbc.2018.09.006>
- Lemke E, Madsen L, Dains J (2017) Vaginal testosterone for management of aromatase inhibitor–related sexual dysfunction: an integrative review. *Oncol Nurs Forum* 44(3):296–301. <https://doi.org/10.1188/17.ONF.296-301>
- Lewis-Smith H, Diedrichs PC, Rumsey N, Harcourt D (2018) Efficacy of psychosocial and physical activity-based interventions to improve body image among women treated for breast cancer: a systematic review. *Psycho-Oncology* 27(12):2687–2699. <https://doi.org/10.1002/pon.4870>
- Lovelace DL, McDaniel LR, Golden D (2019) Long-term effects of breast cancer surgery, treatment, and survivor care. *J Midwifery Womens Health* 64(6):713–724. <https://doi.org/10.1111/jmwh.13012>
- Makluf ASD, Barra AA, Figueiredo EM, Silva GR, Ribeiro RFR, Barros CP, Barra JS (2018) Machine translated by Google Influência da Atividade Física na Qualidade de Vida de Pacientes com Câncer de Mama, vol 5, pp 7787–7790
- Martins Faria B, Martins Rodrigues I, Verri Marquez L, Da Silva Pires U, Vilges de Oliveira S (2021) The impact of mastectomy on body image and sexuality in women with breast cancer: a systematic review. *Psicooncologia* 18(1):91–115. <https://doi.org/10.5209/psic.74534>
- Meyer-Bahlburg HFL, Dolezal C (2007) The Female Sexual Function Index: a methodological critique and suggestions for

- improvement. *J Sex Marital Ther* 33(3):217–224. <https://doi.org/10.1080/00926230701267852>
- Moon Z, Hunter MS, Moss-Morris R, Hughes LD (2017) Factors related to the experience of menopausal symptoms in women prescribed tamoxifen. *J Psychosom Obstet Gynecol* 38(3):226–235. <https://doi.org/10.1080/0167482X.2016.1216963>
- Nekoolaltak M, Keshavarz Z, Simbar M, Nazari AM, Baghestani AR (2017) Women's orgasm obstacles: a qualitative study. *Int J Reprod Biomed* 15(8):479–490
- Oh-Young C, Gordon HRD, Xing X, Filler J (2018) Meta-analytic procedures for career and technical education post-secondary researchers and practitioners. *Journal of Research in Technical Careers* 2(1):32. <https://doi.org/10.9741/2578-2118.1010>
- Paiva CE, Rezende FF, Paiva BSR, Mauad EC, Zucca-Matthes G, Carnesecca EC, Syrjänen KJ, Schover LR (2016) Associations of body mass index and physical activity with sexual dysfunction in breast cancer survivors. *Arch Sex Behav* 45(8):2057–2068. <https://doi.org/10.1007/s10508-016-0758-7>
- Pinto BM, Trunzo JJ (2004) Body esteem and mood among sedentary and active breast cancer survivors. *Mayo Clin Proc* 79(2):181–186. <https://doi.org/10.4065/79.2.181>
- Ribeiro FE, Vanderlei LCM, Palma MR, Tebar WR, Caldeira DT, Teles Fregonesi CEP, Christofaro DGD (2018) Body dissatisfaction and its relationship with overweight, sedentary behavior and physical activity in survivors of breast cancer. *Eur J Obstet Gynecol Reprod Biol* 229:153–158. <https://doi.org/10.1016/j.ejogrb.2018.08.581>
- Rosenberg M (1965) *Society and the adolescent self-image*. Princeton University Press
- Rosenberg M, Schooler C, Schoenbach C, Rosenberg F (1995) Global self-esteem and specific self-esteem: different concepts, different outcomes. *Am Sociol Rev* 60(1):141. <https://doi.org/10.2307/2096350>
- Rosenberg SM, Dominici LS, Gelber S, Poorvu PD, Ruddy KJ, Wong JS, Tamimi RM, Schapira L, Come S, Peppercorn JM, Borges VF, Partridge AH (2020) Association of breast cancer surgery with quality of life and psychosocial well-being in young breast cancer survivors. *JAMA Surg* 155(11):1035. <https://doi.org/10.1001/jamasurg.2020.3325>
- Thiel RRC, Dambros M, Palma PCR, Thiel M, Riccetto CLZ, Ramos MF (2008) Tradução para português, adaptação cultural e validação do Female Sexual Function Index. *Rev Bras Ginecol Obstet* 30(10):504–510. <https://doi.org/10.1590/S0100-72032008001000005>
- Ruddy KJ, Stan DL, Bhagra A, Jurisson M, Cheville AL (2017) Alternative exercise traditions in cancer rehabilitation. *Phys Med Rehabil Clin N Am* 28(1):181–192. <https://doi.org/10.1016/j.pmr.2016.08.002>
- Speck RM, Gross CR, Hormes JM, Ahmed RL, Lytle LA, Hwang W-T, Schmitz KH (2010) Changes in the Body Image and Relationship Scale following a one-year strength training trial for breast cancer survivors with or at risk for lymphedema. *Breast Cancer Res Treat* 121(2):421–430. <https://doi.org/10.1007/s10549-009-0550-7>
- Stan DL, Rausch SM, Sundt K, Cheville AL, Youdas JW, Krause DA, Boughey JC, Walsh MF, Cha SS, Pruthi S (2012) Pilates for breast cancer survivors. *Clin J Oncol Nurs* 16(2):131–141. <https://doi.org/10.1188/12.CJON.131-141>
- Taylor S, Harley C, Ziegler L, Brown J, Velikova G (2011) Interventions for sexual problems following treatment for breast cancer: a systematic review. *Breast Cancer Res Treat* 130(3):711–724. <https://doi.org/10.1007/s10549-011-1722-9>
- Tournillon A, Siegler IA (2021) Voluntary control of pelvic frontal rotations in belly dance experts. *Hum Mov Sci* 77:102791. <https://doi.org/10.1016/j.humov.2021.102791>
- Yan R, Yu J, Tanimoto T, Ozaki A, Lu X, Che B, Zhang Y, Chen P, Wang J (2020) The relationship between sexual activity and sexual attitudes among breast cancer survivors in China. *Cancer Med* 9(10):3425–3436. <https://doi.org/10.1002/cam4.2874>
- Zehra S, Doyle F, Barry M, Walsh S, Kell MR (2020) Health-related quality of life following breast reconstruction compared to total mastectomy and breast-conserving surgery among breast cancer survivors: a systematic review and meta-analysis. *Breast Cancer* 27(4):534–566. <https://doi.org/10.1007/s12282-020-01076-1>

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