What is the evidence of dance and Pilates interventions on the psychological aspects and sexual function of female breast cancer survivors? A systematic review with meta-analysis of randomized trials

¿Cuál es la evidencia de las intervenciones de danza y pilates sobre los aspectos psicológicos y la función sexual de las mujeres sobrevivientes de cáncer de mama? Una revisión sistemática con metanálisis de ensayos aleatorizados

Authors

Juliana da Silveira [1]
Larissa Altenhofen Groth [1]
Danielly Yani Fausto [1]
Leonessa Boing [1]
Julia Cristina Barcelos de Souza
Julia Beatriz Bocchi Martins[1]
Patricia Severo dos Santos Saraiva[1]
Adriana Coutinho de Azevedo Guimarães[1]

[1] Santa Catarina State University (Brazil)

Corresponding author:
Juliana da Silveira
Judasilveira8@gmail.com

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Abstract

Introduction: Breast cancer has the highest mortality rate among women worldwide. It is estimated that physical exercise can be beneficial in preventing as well as treating the disease.
Objective: To analyze dance and/or Pilates interventions and describe their effects on psychological aspects and sexual function in women who are breast cancer survivors.
Methods: The studies were identified in five databases, published between 2012 and 2023, following the PRISMA guidelines, registered in PROSPERO. The PEDro and Cochrane Rob2 scales were used to assess the quality of the studies. Effects were reported with mean differences, standard deviations and 95% confidence intervals and the I2 test was used to assess heterogeneity.
Results: Seven studies were included in the systematic review, of which six were included in the meta-analysis. In general, the studies showed no heterogeneity (I2 = 0%; p=1.00), dance showed high heterogeneity (I2 = 77%; p<0.01), Pilates showed high heterogeneity (I2 = 89%; p< 0.01). Self-esteem showed low heterogeneity (I2 = 0%; p=0.58), stress, average (I2 = 38%; p=0.18), while the variables that showed high were sexual function (I2 = 77%; p=0.01), body image (I2 = 69%; p=0.04), depressive symptoms (I2 = 68%; p=0.01) and optimism (I2 = 63%; p=0.01).
Conclusion: Both interventions proved to be efficient in psychological aspects and sexual function, however, more studies with dance and Pilates are needed for breast cancer survivors in the variables self-esteem and optimism.

Keywords

Breast neoplasms; dance therapy; exercise; exercise and movement techniques; psychological stress.

Resumen

Introducción: El cáncer de mama tiene la tasa de mortalidad más alta entre las mujeres a nivel mundial. Se estima que el ejercicio físico puede ser beneficioso tanto en la prevención como en el tratamiento de la enfermedad.
Objetivo: Analizar las intervenciones de danza y/o pilates y describir sus efectos sobre los aspectos psicológicos y la función sexual en mujeres sobrevivientes de cáncer de mama.
Métodos: Los estudios se identificaron en cinco bases de datos, publicados entre 2012 y 2023, siguiendo las directrices PRISMA y registrados en PROSPERO. Se utilizaron las escalas PEDro y Cochrane Rob2 para evaluar la calidad de los estudios. Los efectos se informaron con diferencias de medias, desviaciones estándar e intervalos de confianza del 95%, y se utilizó la prueba I^2 para evaluar la heterogeneidad.
Resultados: Se incluyeron siete estudios en la revisión sistemática, de los cuales seis se incluyeron en el metanálisis. En general, los estudios no mostraron heterogeneidad (I2 = 0%; p=1,00), la danza mostró alta heterogeneidad (I2 = 77%; p<0,01), Pilates mostró alta heterogeneidad (I2 = 89%; p< 0,01). La autoestima mostró baja heterogeneidad (I2 = 0%; p=0,58), estrés, promedio (I2 = 38%; p=0,18), mientras que las variables que mostraron alta fueron función sexual (I2 = 77%; p=0,01), imagen corporal (I2 = 69%; p=0,04), síntomas depresivos (I2 = 68%; p=0,01) y optimismo (I2 = 63%; p=0,01).
Conclusión: Ambas intervenciones demostraron ser eficientes en aspectos psicológicos y de función sexual, sin embargo, se necesitan más estudios con danza y Pilates para las sobrevivientes de cáncer de mama en las variables autoestima y optimismo.

Palabras clave

Danzaterapia; ejercicio; estrés psicológico; neoplasias de mama; técnicas de ejercicio y movimiento.

Introduction

Breast cancer is the most commonly diagnosed cancer in women and represents a major global public health challenge. According to global estimates, approximately one in every eight cancer diagnoses is breast cancer (Sung et al., 2021), with 2.3 million new cases reported in 2020 alone (World Health Organization, 2023). This accounts for nearly 25% of all cancer diagnoses among women worldwide (Instituto Nacional de Câncer, 2022). Although mortality rates from breast cancer have decreased steadily since 1989—likely due to improved awareness, earlier detection, and advances in treatment Technologies (World Health Organization, 2023)—it remains the leading cause of cancer-related death among women globally (Giaquinto et al., 2022).

Current trends highlight a growing incidence of breast cancer in low- and middle-income countries, where access to screening and treatment remains limited, exacerbating inequalities in health outcomes. In addition to its physical and psychological toll, breast cancer imposes a significant economic and social burden, affecting patients, families, and healthcare systems (Newman, 2022). From a preventive standpoint, it is estimated that approximately 30% of breast cancer cases are attributable to modifiable risk factors, including smoking, unhealthy diet, alcohol and drug use, and physical inactivity (Islami et al., 2018). These findings emphasize the need for integrated strategies that combine early detection, equitable access to care, and promotion of healthy behaviors.

In this context, physical exercise interventions that integrate mind and body approaches, such as dance and Pilates, are gaining attention for their potential benefits in the prevention and rehabilitation of breast cancer (Ortega et al., 2020). Unlike conventional exercise modalities, these approaches emphasize not only physical conditioning but also body awareness, coordination, and emotional expression (Caldwell et al., 2013; Elisa Teixeira de Souza, 2020), which may be particularly valuable for women coping with the physical and psychosocial effects of breast cancer.

Recent studies have demonstrated several benefits of these modalities for breast cancer survivors. Regarding Pilates, research has reported improvements in posture (Fretta et al., 2021), shoulder range of motion (Leite et al., 2021), body image (Boing, de Bem Fretta, et al., 2023), fatigue, and sleep quality (Boing, Fretta, et al., 2023). Dance interventions have shown positive effects on body image, sexual function (Boing, de Bem Fretta, et al., 2023), fatigue (Boing, Fretta, et al., 2023), sleep disturbances, depressive symptoms, quality of life (He et al., 2022), pain, stress (Ho et al., 2016), and shoulder range of motion (Leite et al., 2021). Despite the growing number of studies, most of the existing research has focused on short-term outcomes and has involved heterogeneous methodologies, making it difficult to generalize findings. Moreover, few randomized controlled trials have compared the efficacy of these mind-body practices directly with more traditional forms of exercise. Therefore, further studies are needed to deepen the understanding of how and to what extent interventions such as dance and Pilates can contribute to the multidimensional recovery of breast cancer survivors, particularly in aspects related to mental health, self-perception, and functional autonomy.

Although the literature highlights physical and psychological benefits of mind-body interventions, few systematic reviews have specifically focused on dance and Pilates as isolated approaches (Boing et al., 2017; Costa et al., 2022; Espíndula et al., 2017; Fatkulina et al., 2021; Pinto-Carral et al., 2018). Moreover, no systematic reviews were found that simultaneously examined both modalities in relation to psychological health and sexual function. Addressing psychological and sexual aspects is essential, as these are often negatively affected by breast cancer diagnosis and treatment, leading to distress, impaired body image, reduced quality of life, and intimate relationship challenges. Despite their impact, these dimensions are frequently underexplored in oncological care. Therefore, it is expected that this review will provide more precise and comprehensive evidence on the potential of dance and Pilates as complementary, non-pharmacological strategies for improving psychological well-being and sexual function in breast cancer survivors. Thus, the aim of this systematic review is to analyze interventions involving dance and/or Pilates and describe their effects on psychological aspects and sexual function in women who are breast cancer survivors.

Method

Registration and protocol

This systematic review with meta-analysis followed the guidelines and recommendations Preferred reporting items for Systematic Reviews and Meta-analysis – PRISMA (Hutton et al., 2015) and was registered in PROSPERO (International Prospective Register of Systematic Reviews, 2016) (Booth et al., 2012) CRD42023457261, exempt from approval by Institutional Review Board as it did not involve the participation of human beings. The guiding question was formed through the acronym PICOS: What are the effects of dance and/or Pilates interventions on the psychological aspects and sexual function of women survivors of breast cancer?

Search strategy

The search was carried out electronically using the descriptors referred to in table 1, in five databases, namely: Apa PsycNet, PubMed Central®; Medline (Ovid); Scopus Elsevier and Web of science - core collection. All titles and abstracts found in the electronic search were analyzed using the Rayyan application, developed by the Qatar Computing Research Institute (Ouzzani et al., 2016), by the researchers (JS, JBBM, PSSS and LB), blindly and independently, between 08/24/2023 and 09/20/2023. The reference lists of all sizeable articles were examined to identify other eligible studies.

Table 1. Complete search strategy in electronic databases.

Terms	Descriptors
#1 Population	"Breast cancer" OR "Breast neoplasms" OR "Mammary carcinoma"
#2 Disease	"Mental health" OR "Psychological well-being" OR "Psychological aspects" OR "Psychosocial" OR "Emotional well-being" OR "Depressive symptoms" OR "Depression" OR "Optimism" OR "Self-esteem" OR "Body image" OR "Stress" OR "Anxiety" OR "Sexual function" OR "Sexual health" OR "Sexual dysfunction"
#3 Intervention	"Dance" OR "Dance therapy" OR "Movement therapy" OR "Expressive dance" OR "Creative dance" OR "Pilates" OR "Pilates-based exercises"
#4 Study	"Randomized clinical trial" OR "Randomized controlled trial" OR "RCT"
Combination	#1 AND #2 AND #3 AND

Note: The search strategy used in Web of Science was as follows: TS=("breast cancer" OR "breast cancer survivors" OR "breast neoplasms" OR "post-treatment breast cancer" OR "breast cancer rehabilitation") AND TS=("mental health" OR "psychological well-being" OR psychosocial OR depression OR anxiety OR stress OR mood OR "quality of life" OR "emotional health" OR "sexual function" OR "sexual dysfunction" OR "sexual health") AND TS=(dance OR "dance therapy" OR "movement therapy" OR pilates OR "pilates-based exercise"). The search strategy presented here is an example from the Web of Science database. After the initial search, filters for publication year, document type, and study design were applied within the platform to refine results. Similar search strategies were adapted and applied to other databases.

Eligibility criteria

The studies eligible for this review were: randomized clinical trials; conducted on adult women (≥18 years) who were breast cancer survivors; studies publish in English, Portuguese and Spanish; published between 2012 and 2023; who used dance and/or Pilates interventions to improve on sexual function, self-esteem, stress, body image, optimism and depressive symptoms in breast cancer survivors; studies with abstract and full text.

Table 2. Eligibility criteria for inclusion of studies.

		Inclusion criteria	Exclusion Criteria
P	Participants	Women who are breast cancer survivors; older than 18 years.	Men with breast cancer.
I	Intervention	Dance and/or Pilates.	Physiotherapy, body practices and/or other types of physical exercise.
C	Comparison	Group control.	No control group.
O	Outcome	Effects of interventions on self-esteem, stress, sexual function, body image, optimism and depressive symptoms.	Studies without instruments for psychological aspects.
S	Study	Randomized clinical trials.	Non-randomized or quasi-randomized clinical trials, observational studies, reviews, cross-sectional studies, pilot studies, protocol studies, qualitative studies, conference abstracts or proceedings, editorials, theses, letters to the editors, short reports.

After searching the databases, duplicates were removed and titles and abstracts were screened using the Rayyan application, which allows for importing and exporting references, labeling and filtering citations, categorizing studies as 'included', 'excluded', or 'uncertain', blinding between reviewers, and automatically identifying potential duplicates. Full texts of potentially eligible studies were then read to complete the selection process according to the predefined criteria. Details of the study selection process are shown in Figure 1, which presents the flowchart of the search strategy, selection steps, and reasons for article exclusion.

Outcomes evaluated

Data were extracted following a structured and pre-established model, constructed with the information: (a) details of the journal (authorship, year and type of study, impact factor and country where the study was carried out, number of citations according to based on Web of Science); (b) study title and objectives; (c) sample size, intervention group, duration, frequency, time, intensity of interventions; (d) financing; (e) comparison group; (f) outcomes and instruments used; (g) effects of dance and/or Pilates; (h) level of evidence following the PRISMA 27-item checklist (yes or no); (i) evaluation using the PEDro scale.

Quality of studies and risk of bias

The methodological quality of the studies was assessed using two scales, the Cochrane RoB2 (Revised Cochrane risk-of-bias tool for randomized trials –version 2) collaboration scale (Higgins et al., 2022), in which the following criteria were assessed: (1) bias in the randomization process, (2) deviations from the intended intervention, (3) bias due to missing outcome data, (4) bias in the measurement of missing outcomes, and (5) bias in the selection of reported outcomes. The graphical presentation of the risk of bias assessment was developed by RevMan V.5.4.1. Furthermore, the PEDro Scale (Physiotherapy Evidence Database Scale) (Maher et al., 2003), uses 11 questions ("yes"/"no"), in order to evaluate the internal validity of clinical trials, and scores vary between 0 and 10 points.

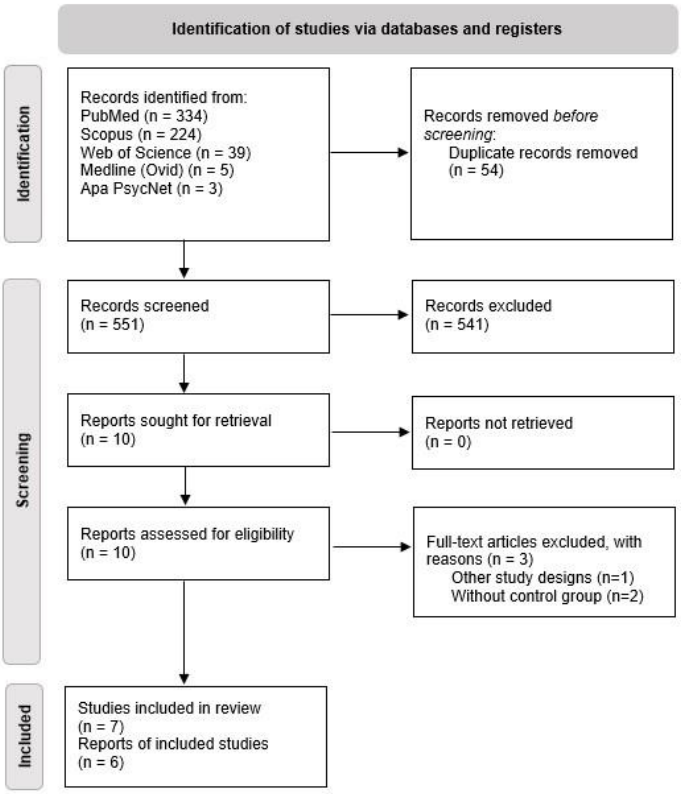
Meta-analysis

To analyze the difference in effect between the intervention and control groups, the primary outcomes were the questionnaire scores related to the variables of sexual function, self-esteem, stress, body image, depressive symptoms, and optimism in the post-intervention period for both groups. The intervention groups consisted of participants who underwent structured dance and Pilates programs, while the control groups included participants who received another type of physical exercise, usual care, or were placed on a waiting list. For these continuous results, the difference in Means (M), Standard Deviations (SD), and sample size for each group were extracted and calculated as an effect estimate. When these data were not available, the original study authors were asked for missing or incomplete information. Higgins and Green I2 (Egger et al., 1997) were used to determine the heterogeneity of effect of the studies, using a random effects model with 95% CI (Confidence Interval). I2 values were interpreted as follows: 0% to 25% low heterogeneity; 26% to 50% medium heterogeneity; >50% high heterogeneity. Subgroup analyses were used to determine the reason for heterogeneity when the meta-analysis revealed heterogeneity. Subgroup analyzes were carried out based on the type of physical exercise (dance and Pilates), and the aforementioned outcomes. The funnel plot method was used to measure publication bias. The data and graphical presentation of forest and funnel plots were performed using the R-package Meta (Viechtbauer, 2010).

Results

A total of 605 articles were found in the initial database search: 3 in Apa PsycNet, 334 in Pubmed Central®, 5 in Medline (Ovid), 224 in Scopus Elsevier and 39 in Web of Science – main collection. 54 articles were excluded because they were cross-references. Following reading of the titles and abstracts, 544 articles were excluded as they did not meet the inclusion criteria. After reading in full, 7 articles were eligible for this review (figure 1), of which 6 were included in the meta-analysis.

Figure 1. Flowchart of the study selection strategy, according to the PRISMA 2020 model.



Participants

A total of 607 women were included: 336 in the intervention groups and 271 in the control groups. Included were women receiving hormonal therapy (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Denig et al., 2022; Leite et al., 2021), undergoing radiotherapy (Ho et al., 2018), awaiting radiotherapy (Ho et al., 2016) and undergoing breast cancer surgery and scheduled to receive chemotherapy (He et al., 2022). Regarding the stage of the disease, all participants were in stages 0 to III.

The mean age of the participants was 53.1 ± 4.3 years and varied according to the inclusion criteria, being over 18 years old (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Denig et al., 2022; He et al., 2022; Ho et al., 2016; Leite et al., 2021) and one study only included the mean age of the participants as 49.4 ±8.1 years (Ho et al., 2018).

General aspects of the studies

The impact factor of the journals varied between 3.0 (Boing, Fretta, et al., 2023; Leite et al., 2021) and 8.1 (He et al., 2022), and one study had no impact factor (Denig et al., 2022). Of the seven articles included, five were cited in the Web of Science, with counts 1 (Boing, de Bem Fretta, et al., 2023), 3 (Boing, Fretta, et al., 2023; He et al., 2022), 20 (Ho et al., 2018) and 60 (Ho et al., 2016) citations, checked on September 27, 2023.

Studies were carried out in South America (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Denig et al., 2022; Leite et al., 2021) and Asia (He et al., 2022; Ho et al., 2016, 2018).

Among the seven studies, two did not provide information about registration in a clinical trials database (He et al., 2022; Ho et al., 2018), while the other five (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Denig et al., 2022; Ho et al., 2016; Leite et al., 2021) were registered.

Regarding the declaration of conflicts of interest, five studies declared no conflict of interest (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; He et al., 2022; Ho et al., 2018; Leite et al., 2021) and two studies did not provide information on this item (Denig et al., 2022; Ho et al., 2016).

Control group

It was observed that all seven studies included a control group. In the studies Boing, de Bem Fretta, et al. (2023); Boing, Fretta, et al. (2023); Denig et al. (2022); Leite et al. (2021), the control groups received educational activities without physical exercise. In the studies by Ho et al. (2016, 2018) the control groups continued with usual care consisting of standard radiotherapy treatment only. In the study by He et al. (2022), the control group received instructions to avoid physical exercise during the intervention period.

Intervention group

Type of intervention

The interventions were namely, Dance Movement Therapy (DMT) (Ho et al., 2016, 2018), belly dance (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Denig et al., 2022; Leite et al., 2021), Chinese dance (He et al., 2022) and Pilates (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Leite et al., 2021). The details of the intervention characteristics are described in Table 3.

Table 3. Details of selected studies.

Author/year	Type of intervention	Number of participants	Duration of intervention	Frequency	Session time	Intensity	Variables investigated/Instruments	Professionals/Place where interventions were carried out
1.Boing et al., 2023a	Belly dancing and Pilates	52 (Belly dance: 18; Pilates: 18; Control group: 16)	16 weeks, with follow-up of 6 and 12 months	3 times a week	60 minutes	Progressive	Body Image (BIBCQ); Self esteem (RSS); Sexual Function (FSFI).	Center for Oncological Research/Physical education professional with experience in dance and certified physiotherapist in Pilates.
2.Boing et al., 2023b	Belly dancing and Pilates	52 (Belly dance: 18; Pilates: 18; Control group: 16)	16 weeks, with follow-up of 6 and 12 months	3 times a week	60 minutes	Progressive	Depressive Symptoms (DBI), Stress (PSS), Optimism(LOT).	Center for Oncological Research/Physical education professional with experience in dance and certified physiotherapist in Pilates.
3.Denig et al., 2022	Belly dance	24 (Belly dance: 11; Control group: 13)	16 weeks	3 times a week	60 minutes	Progressive	Sexual Function (FSFI); Body Image (BIBCQ)	Center for Oncological Research/Physical education professional with experience in dance.
4.Leite et al., 2021	Belly dancing and Pilates	52 (Belly dance: 18; Pilates: 18; Control group: 16)	16 weeks	3 times a week	60 minutes	Progressive	Self Esteem (RSS); Depressive Symptoms (DBI)	Center for Oncological Research/Physical education professional with experience in dance and certified physiotherapist in Pilates.
5.He et al., 2022	Chinese dance	176 (Dance: 88; Control group: 88)	16 weeks at home and 6 sessions in the hospital	During the hospitalization process for chemotherapy	The first session lasts 60 minutes and the rest lasts 30 minutes	-	Depressive Symptoms (PHQ-9)	Hospital and home/Dance instructor.
6.Ho et al., 2016	Dance Movement Therapy	130 (DMT: 66; Control group: 64)	3 weeks	2 times a week	90 minutes	-	Stress (PSS); Depressive Symptoms (HADS)	Qualified professionals in dance movement therapy/Hospital, community center and university.
7.Ho; Fong; Yip, 2018	Dance Movement Therapy	121 (DMT: 63; Control group: 58)	3 weeks	2 times a week	90 minutes	-	Stress (PSS)	Qualified professionals in dance movement therapy/Location not specified.

Abbreviations: BIBCQ: Body Image After Breast Cancer Questionnaire; BDI: Beck Depression Inventory; DMT: Dance Movement Therapy; RSE: Rosenberg Self-Esteem; FSFI: Female Sexual Function Index; HADS: The Hospital Anxiety and Depression Scale; PHQ-9: 9-item Patient Health Questionnaire; PSS: Perceived Stress Scale; LOT: Life Orientation Test.

Quality of studies

Five studies scored 8 on the PEDro scale (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Denig et al., 2022; He et al., 2022; Leite et al., 2021) and two studies scored 7 (Ho et al., 2016, 2018), as shown in table 4. According to the PEDro scale, scores of 6 to 10 are considered indicative of high methodological quality. The main limitations that reduced scores were related to the impossibility of blinding participants and therapists in physical exercise interventions, which is a common challenge in this type of study.

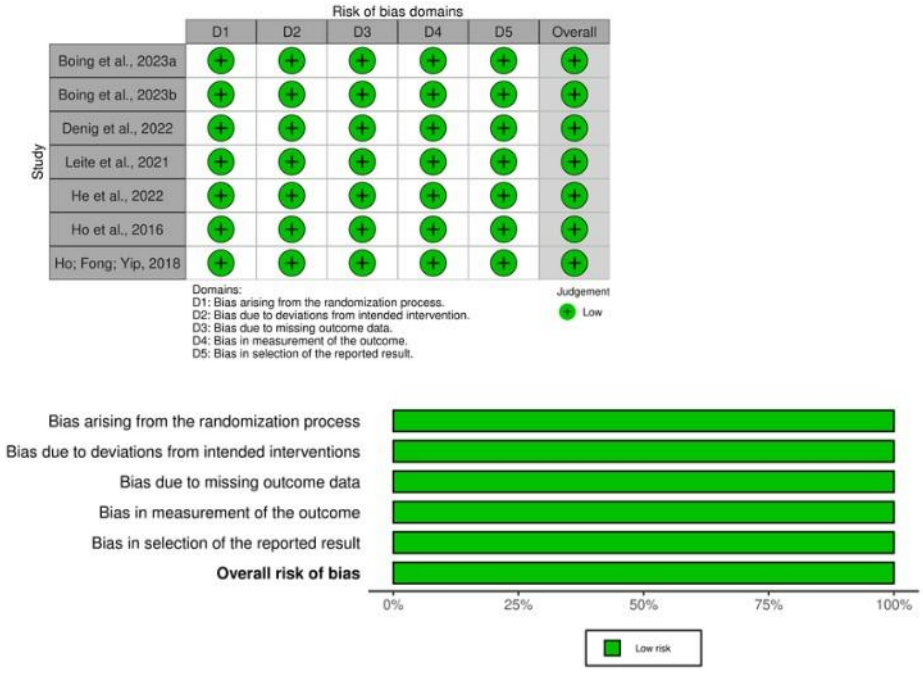
According to the Cochrane RoB 2 tool (Figure 2), all included studies were rated as having a low risk of bias. This means that, based on the tool's criteria, the studies were well designed and conducted in a way that minimizes potential sources of bias in the results, thereby increasing the reliability of their findings.

Table 4. PEDro scale of included studies.

Studies PEDro Scale	Boing et al., 2023a	Boing et al., 2023b	Denig et al., 2022	Leite et al., 2021	He et al., 2022	Ho et al., 2016	Ho; Fong; Yip, 2018
1. Eligibility Criteria	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Random distribution	1	1	1	1	1	1	1
3. Secret allocation of subjects	1	1	1	1	1	1	1
4. Initial similarity between groups	1	1	1	1	1	1	1
5. "Blinding" of subjects	0	0	0	0	0	0	0
6. "Blinding" of therapists	0	0	0	0	0	0	0
7. "Blinding" of evaluators	1	1	1	1	1	0	0
8. Adequate follow-up	1	1	1	1	1	1	1
9. Analysis of intention to treat	1	1	1	1	1	1	1
10. Intergroup comparisons	1	1	1	1	1	1	1
11. Precision and variability measures	1	1	1	1	1	1	1
TOTAL SCORE	8/10	8/10	8/10	8/10	8/10	7/10	7/10

Legend: 0 = no; 1 = yes.

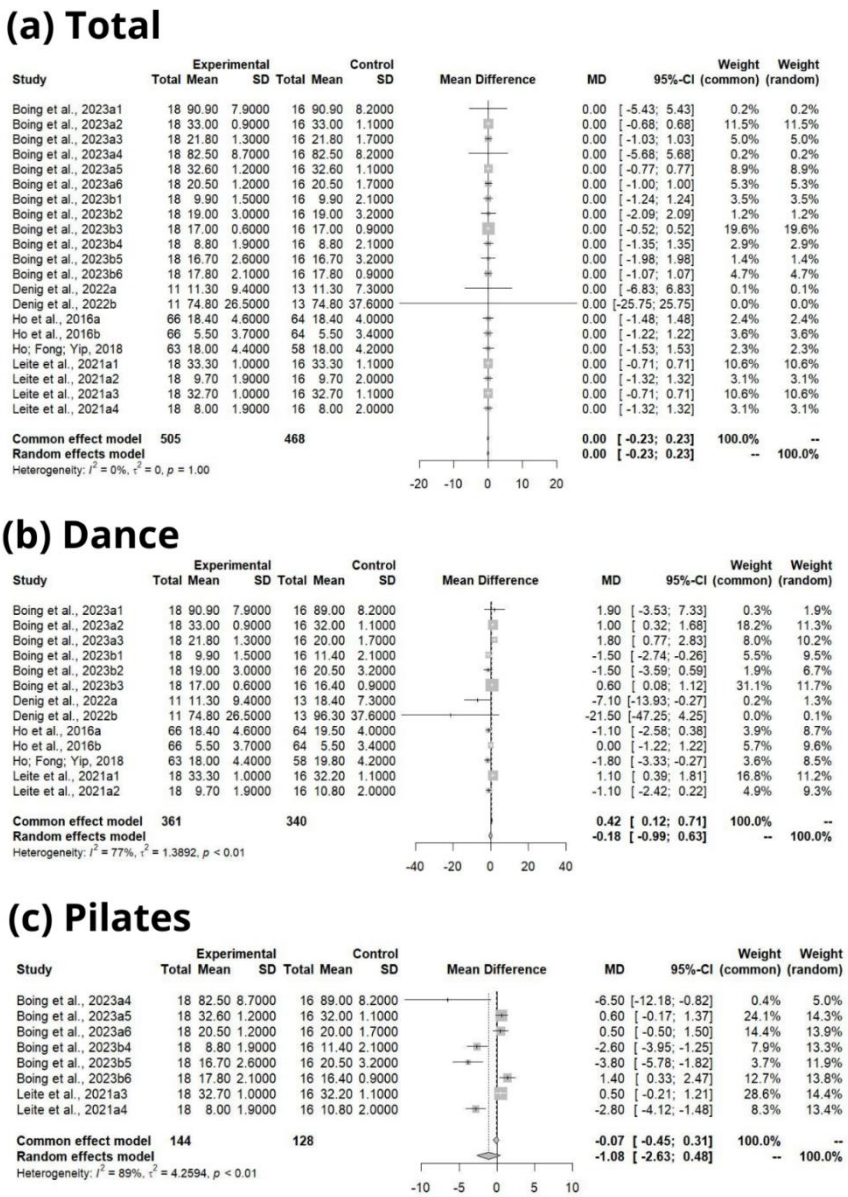
Figure 2. Chart and summary for Cochrane Rob2 risk of bias assessment for included randomized controlled trials.



Meta-analysis

A total of six studies with dance and Pilates, which investigated the aforementioned variables, were included in the meta-analysis. One study was excluded because the mean and standard deviation were not reported and were unavailable after contacting the authors; this study presented only the median value and standard deviation (He et al., 2022). All studies had a control group, so the meta-analysis presents the post-intervention results of both groups. Three studies included two intervention groups, namely Boing, de Bem Fretta, et al. (2023); Boing, Fretta, et al. (2023) and Leite et al. (2021), all with belly dancing and Pilates. For these studies, the following classification was adopted: Boing, de Bem Fretta, et al. (2023) a1: belly dancing in body image; a2: belly dancing in self-esteem; a3: belly dancing in sexual function; a4 Pilates in body image; a5: Pilates for self-esteem; a6: Pilates in sexual function; Boing, Fretta, et al. (2023) b1: belly dancing in depressive symptoms; b2: belly dancing in stress; b3: belly dancing in optimism; b4: Pilates for depressive symptoms; b5: Pilates in stress; b6: Pilates in optimism; Leite et al. (2021) a1: belly dancing in self-esteem; a2: belly dancing in depressive symptoms; a3: Pilates for self-esteem; a4: Pilates for depressive symptoms. Furthermore, Denig et al. (2022) was adopted. a: dance in sexual function and b: in body image. Ho et al. (2016) a: dancing in stress and b: depressive symptoms. The results are presented in figures 3, 4, 5 and 6.

Figure 3. Forest plot of variables after dance and/or Pilates interventions in women who are breast cancer survivors.



In general, the studies did not show heterogeneity (I2 = 0%; 95%CI [-0.23;0.23]; MD = 0; Ţ2 = 0; p=1.00). In the subgroup analysis of interventions, dance showed high heterogeneity (I2 = 77%; 95%CI [-0.99;0.63]; MD = -0.18; Ţ2 = 1.3892; p < 0.01); like Pilates, it also showed high heterogeneity (I2 = 89%; 95% CI [-2.63; 0.48]; MD = -1.08; p <0.01) (figure 2).

Figure 4. Forest Plot of subgroups of the investigated variables (self esteem and depressive symptoms).

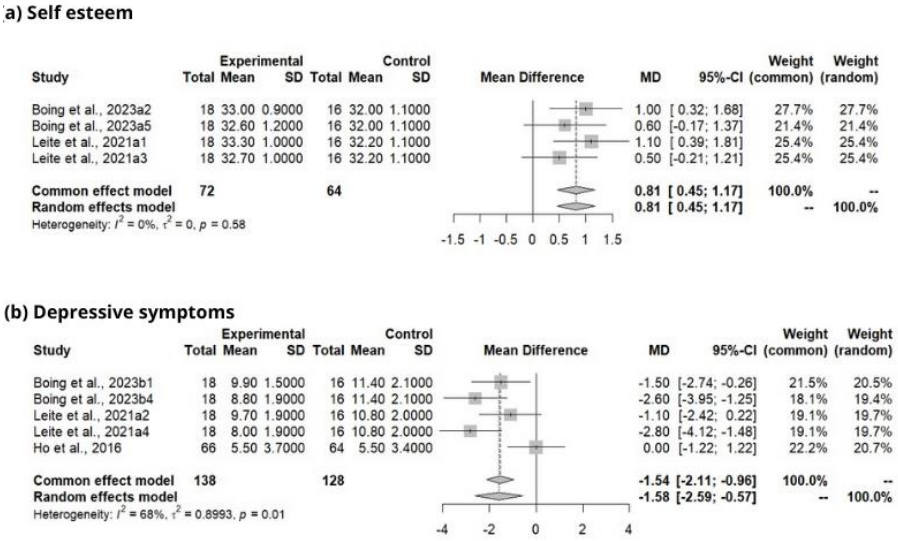


Figure 5. Forest Plot of subgroups of the investigated variables (stress and sexual function).

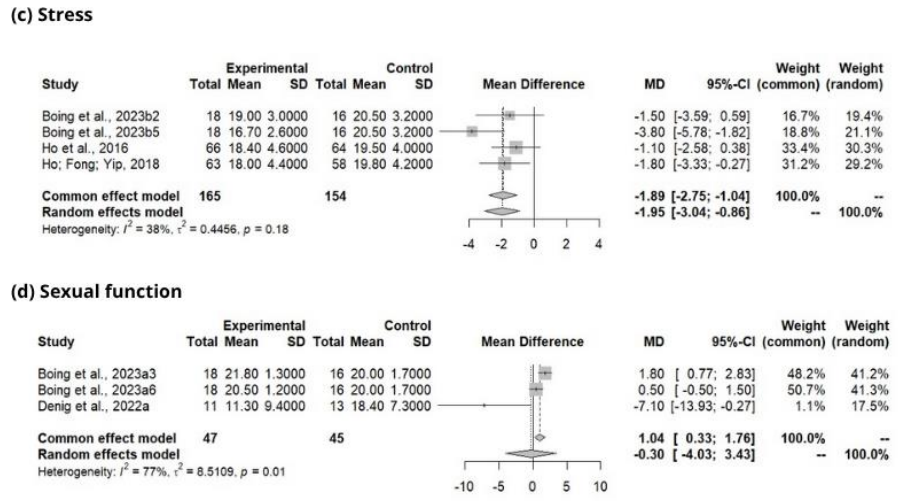
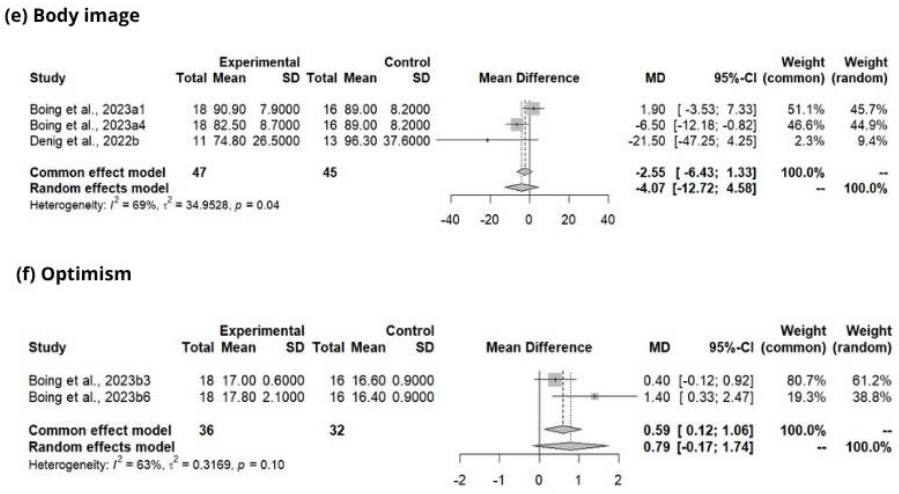
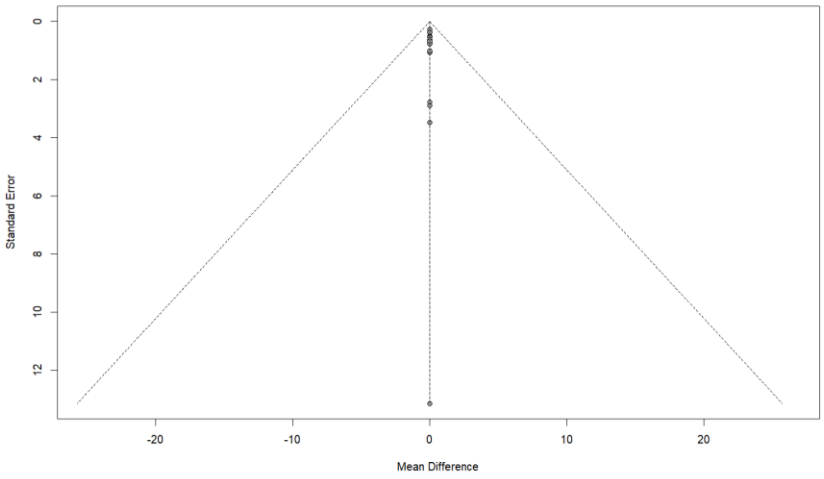


Figure 6. Forest Plot of subgroups of the investigated variables (body image and optimism).



In the subgroup analysis of variables regarding self-esteem, low heterogeneity was observed (I2 = 0%; MD = 0.81; IC95 [0.45; 1.17; Ţ2 = 0; p = 0.58); stress showed medium heterogeneity (I2 = 38%; MD = -1.95; 95% CI [-3.04; -0.86]; Ţ2 = 0.4456; p = 0.18); sexual function showed high heterogeneity (I2 = 77%; MD = -0.30; 95% CI [-4.03; 3.43]; Ţ2 = 8.5109; p = 0.01); body image observed high heterogeneity (I2 = 69%; MD = -4.07; 95% CI [-12.72; 4.58]; Ţ2 = 34.9528; p = 0.04), depressive symptoms (I2 = 68 %; MD = -1.58; 95% CI [-2.59; -0.57]; Ţ2 = 0.8993; p = 0.01); and optimism showed high heterogeneity (I2 = 63%; MD = 0.79; 95%CI [-0.17; 1.74]; Ţ2 = 0.3169; p = 0.10). Furthermore, the funnel graph (figure 4) did not imply publication bias, due to its symmetrical format.

Figure 7. Funnel Plot of all variables investigated with dance and/or Pilates interventions.



Discussion

The objective of this systematic review with meta-analysis was to analyze the evidence of dance and/or Pilates interventions and describe their effects on psychological aspects and sexual function in women survivors of breast cancer. That said, the results suggest positive evidence about the effects of dance and/or Pilates on the psychological aspects and sexual function of breast cancer survivors in general, however these effects are not as significant on self-esteem and optimism. Furthermore, the studies predominantly used dance (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Denig et al., 2022;

Ho et al., 2016, 2018; Leite et al., 2021), with 282 participants, and only three studies analyzed Pilates (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Leite et al., 2021), with 54 participants.

Detail of interventions

Seven studies investigated dance (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Denig et al., 2022; He et al., 2022; Ho et al., 2016, 2018; Leite et al., 2021) and three studies investigated Pilates (Boing, de Bem Fretta, et al., 2023; Boing, Fretta, et al., 2023; Leite et al., 2021). Despite the high heterogeneity in both types of interventions, when analyzed separately, Pilates appeared to produce more favorable results for the variables assessed. This may be due to greater consistency in frequency, intensity, and duration, which allowed for a more robust analysis. In contrast, dance interventions varied widely in these parameters. Notably, three studies did not report the intensity of the interventions (He et al., 2022; Ho et al., 2016, 2018), which may have affected comparability. According to a recent umbrella review supported by moderate- to high-quality evidence, dance programs are recommended to be conducted once per week for 60 minutes over at least four weeks to yield health benefits(McCrary et al., 2021). For Pilates, no specific dose-response data was found, but longer interventions, with moderate to vigorous intensity, supervised and conducted in group settings, tend to be more effective (Joaquim et al., 2022). These findings align with our review, which showed that Pilates interventions lasted up to 16 weeks, while dance programs ranged from 3 to 16 weeks. Still, both interventions—dance and Pilates—demonstrated benefits in stress reduction, sexual function, body image, and depressive symptoms, reinforcing the idea that engaging in physical activity, regardless of the modality, is better than not engaging at all (Soares Falcetta et al., 2018).

Details of variables and instruments

There is uniformity in the choice of instruments used in the variables of self-esteem (RSS), stress (PSS), sexual function (FSFI), body image (BIBCQ) and optimism (LOT). Regarding depressive symptoms, there was heterogeneity with the use of three different instruments among five studies that analyzed this variable (DBI, HADS and PHQ-9), which probably resulted in the high heterogeneity of this variable, since they suggest possible biases regarding these data.

It is known that depressive symptoms and stress are symptoms commonly presented among breast cancer survivors and are generally the most investigated in this population. That said, another meta-analysis identified that therapeutic physical exercises are recommended to reduce such adverse effects (del-Rosal-Jurado et al., 2020), which corroborates the findings of this meta-analysis, since the practice of dance and Pilates were favorable for these variables.

Regarding sexual function, although the Female Sexual Function Index (FSFI) was used consistently in studies addressing this variable, the meta-analysis did not identify significant improvements after dance or Pilates interventions. This lack of effect may be related to several factors, including the multifactorial nature of sexual dysfunction in breast cancer survivors, which can arise from hormonal, psychological, relational, and treatment-related causes. In addition, the duration and focus of the interventions may not have been sufficient to promote noticeable changes in this domain. Despite the lack of significant results, it is important to continue investigating sexual function in this population, as it remains a fundamental aspect of quality of life. We recommend that future studies adopt longer interventions, include components that specifically address sexual health, and consider the use of qualitative methods to better capture subjective experiences and outcomes.

In general, this meta-analysis showed better results for interventions when compared to control groups, with the exception of the variables self-esteem and optimism. One of the possible causes for these results may have been the choice of instruments used. Instruments were used for the so-called healthy population, however, self-esteem and optimism are directly related to the changes caused by the disease, such as body changes (Lizandra Ellem Silva de Souza et al., 2022), causing a worsening of self-esteem and possible relapses and metastases, which implies a worsening of the outlook for optimism (de Camargos et al., 2020). Therefore, the importance of studying and applying validated instruments for the population that has experienced breast cancer stands out, in order to mitigate possible biases caused by the lack of specific instruments.

Furthermore, the importance of physical exercise for breast cancer survivors stands out, with emphasis on dance and Pilates, as these modalities have already proven to be safe and effective for this population.

Furthermore, the importance of staying active is reinforced, as physical inactivity can lead to a decrease in quality of life and increase the negative psychological impacts arising from the disease (Mok et al., 2022).

Limitations

This study has some limitations such as the heterogeneity of studies regarding interventions, as well as the analysis of subgroups of variables. Still, evidence from the studies included in this systematic review and meta-analysis showed that dance and Pilates are beneficial interventions for stress, sexual function, body image and depressive symptoms. Another limitation found was the lack of data in one of the articles included in the review (He et al., 2022), which did not make the mean and standard deviation values available, even after request from the main author, which made it impossible to carry out the meta-analysis of this study.

Furthermore, the lack of studies analyzing the variables of interest became a limiting factor, since there are few RCT studies with these modalities, that is, the carrying out of new RCTs with the variables evaluated in this study is strongly encouraged.

Strengths and recommendations

Among the strengths of this review are the methodological quality of the included studies (PEDro scale and Cochrane Rob2 scale), which showed excellent scores, demonstrating the care taken by researchers during the process and establishment of the proposed protocol and administration of interventions. Furthermore, of the seven studies included, six were published in journals with an impact factor, as well as five studies with citations in WOS. Another strong point of this review is the originality of this study compared to current literature, since to date no systematic reviews with meta-analysis involving dance and/or Pilates modalities concomitantly have been found, in addition to investigating the psychological and the sexual function of breast cancer survivors.

The findings of this study are relevant to health professionals who work with the population of breast cancer survivors. These results help in clinical decision-making regarding the choice of physical exercise in the variables studied, however, it is important to emphasize that the findings must be interpreted with caution, due to heterogeneity and non-standardization regarding intensity, volume and frequency.

Implications for future research

There is a lack of RCTs involving dance and Pilates for breast cancer survivors, in the variables analyzed in this study, especially in the optimism variable. There is also a need to validate specific instruments for the variables studied for breast cancer survivors, in order to contribute and assist professionals in the area of oncological rehabilitation, as well as in decision-making regarding the clinical issues of the modalities studied.

Conclusions

Dance and Pilates modalities showed high heterogeneity, with better results observed in the variables stress, sexual function, body image and depressive symptoms, after carrying out the interventions. That said, more studies involving dance and Pilates are needed with women who are breast cancer survivors, as well as the validation of instruments used for this population, so that there is a better understanding of the data and results.

While both modalities offer benefits, Pilates demonstrated more consistent outcomes, possibly due to more standardized intervention protocols. These findings may inform clinical decision-making by helping healthcare professionals tailor physical activity interventions according to patient preferences and specific psychological or functional needs.

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Authors and translators' details:

Juliana da Silveira	judasilveira88@gmail.com	Autor/a
Larissa Altenhofen Groth	larissa.groth18@edu.udesc.br	Autor/a
Danielly Yani Fausto	dani.090594@hotmail.com	Autor/a
Leonessa Boing	leonessaboing@gmail.com	Autor/a
Julia Cristina Barcelos de Souza	juliacrissouza1@gmail.com	Autor/a
Júlia Beatriz Bocchi Martins	juliabocchi@gmail.com	Autor/a
Patrícia Severo dos Santos Saraiva	patricia.ed.fisica@hotmail.com	Autor/a
Adriana Coutinho de Azevedo Guimarães	adriana.guimaraes@udesc.br	Autor/a