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Impact of Qi dance on psychological stress, anxiety, and sleep quality among breast cancer patients in the rehabilitation phase: An investigation of intervention efficacy

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Abstract: This study aims to investigate the effects of Qi Dance intervention on psychological stress, anxiety, sleep quality, and overall quality of life in Breast Cancer Convalescent Patients (BCCP). **Methods:** BCCP were randomly assigned to the Qi Dance Group (QDG) and the Control Group (CG), with 36 participants in each group. The Perceived Stress Scale-10 (PSS-10), Self-rating Anxiety Scale (SAS), Pittsburgh Sleep Quality Index (PSQI), and Functional Assessment of Cancer Therapy - Breast (FACT-B) were employed to assess changes in these indicators and their correlations before and after the Qi Dance intervention. **Results:** There were no significant differences between the QDG and CG in PSS, SAS, PSQI, or FACT B at baseline ($P > 0.05$). Compared to pre intervention values, the QDG showed significant improvements in all four measures after the intervention ($P < 0.05$). Furthermore, compared to the CG, the QDG had significantly lower scores in PSS-10 (15.50 ± 2.79 vs. 32.76 ± 2.63 , $P < 0.05$), SAS (45.50 ± 5.09 vs. 59.13 ± 5.58 , $P < 0.05$), and PSQI (7.45 ± 2.74 vs. 15.13 ± 2.75 , $P < 0.05$), and a significantly higher FACT B score (126.66 ± 7.96 vs. 73.00 ± 5.59 , $P < 0.05$). Regression analysis further revealed that Qi Dance intervention significantly reduced perceived stress ($R^2 = 0.75$, $B = -4.78$, 95% CI $[-5.71, -3.86]$, $P < 0.05$), anxiety ($R^2 = 0.72$, $B = -8.57$, 95% CI $[-10.36, -6.80]$, $P < 0.05$), and sleep disturbances ($R^2 = 0.74$, $B = -4.68$, 95% CI $[-5.60, -3.76]$, $P < 0.05$), while significantly improving quality of life ($R^2 = 0.82$, $B = 14.26$, 95% CI $[12.03, 34.49]$, $P < 0.05$) in breast cancer convalescent patients. **Conclusion:** The Qi Dance intervention not only significantly alleviates perceived stress and anxiety, improves sleep quality, but also enhances the overall quality of life in breast cancer convalescent patients. These findings further suggest that incorporating Qi Dance into the treatment plan for BCCP holds potential benefits.

Keywords: Qi dance; BCCP; stress; anxiety; sleep quality

1. Introduction

Breast cancer (BC) has become one of the most common tumor diseases today, accounting for 11.6% of cancer cases and ranking second only to lung cancer [1,2]. This proportion has further increased the burden on global public health, particularly in developing countries with relatively scarce medical resources, where this burden is even more pronounced. Additionally, BC patients are compelled to confront not only physical pain but also complex emotional challenges, such as concerns about disease recurrence and changes in body image [3–5]. These issues further exacerbate symptoms of anxiety, fear, and depression, as well as a decline in sleep quality, including insomnia, difficulty falling asleep, and sudden awakenings [6–9],

during the recovery period, which indirectly affects their quality of life [10]. From a physiological perspective, long-term psychological stress can disrupt the balance of neurotransmitters and the endocrine system, leading to autonomic nervous system disorders and abnormal hormone levels, which can induce anxiety reactions [11,12]. Research indicates that an anxious state activates the sympathetic nervous system and enhances its activity while diminishing parasympathetic nervous system activity, resulting in a decline in sleep quality [13,14]. Moreover, sleep disorders can disrupt the balance of neurotransmitters and norepinephrine in the brain, further exacerbating anxiety reactions and increasing psychological stress [15]. Therefore, addressing the psychological stress, anxiety, and sleep disorders experienced by Breast Cancer Convalescent Patients (BCCP) is essential for improving their rehabilitation outcomes and overall quality of life.

Addressing the mental health challenges faced by BCCP, it was evident that while pharmacological interventions can be effective, they frequently come with significant side effects [16]. Consequently, there is a growing interest in exploring alternative non-pharmacological therapies, such as Qi Dance, Tai Chi, yoga, cognitive behavioral therapy (CBT), and Baduanjin, as viable treatment options for the psychological issues encountered by BCCP. Qi Dance, a novel fitness approach that integrates elements of traditional Qigong, traditional Chinese medicine meridian theory, and modern dance, primarily aims to alleviate the physical and mental health issues associated with stress, anxiety, and sleep disturbances through the synchronized interplay of breath regulation, music, and body movements [17,18]. Research indicates that practicing Qi Dance can significantly reduce anxiety, depression, and stress related to mental strain in healthy women, while also enhancing the functional activities of the nervous system [19]. Furthermore, engaging in Qi Dance can improve the body's flexibility and muscle strength, thereby promoting overall physical health [20].

Despite the substantial body of research indicating the potential benefits of exercise interventions for patients in the recovery phase of BC, this study diverges from previous research in two key aspects. Firstly, it integrates Qi Dance into the treatment regimen for BCCP, offering a novel approach to addressing their psychological well-being. Secondly, it expands the range of psychological interventions available for BCCP, including other BC patients, by providing an alternative therapeutic approach. The objective of this study is to examine the efficacy of Qi Dance as a non-pharmacological intervention in alleviating psychological distress, enhancing quality of life, and improving sleep quality of BCCP. The study's findings are poised to provide a safe, effective, and non-pharmacological alternative treatment for BCCP and patients with other types of cancer, offering them greater choice and benefits.

2. Materials and methods

2.1. Sample recruitment and group settings

From 12 to 29 October 2024, 107 female BC patients aged 40 to 55 in recovery were recruited from two leading hospitals in Shenyang, China. Between 1 and 8 November 2024, the intervention process, how it would work, and the study's inclusion and exclusion criteria were explained to the patients and their families. After this, 76 BC patients agreed to join the study. The participants were randomly assigned to a Qi Dance group (QDG) and a control group (CG) using a computer-generated random sequence, with 38 participants in each group. The formal intervention

period is scheduled from 11 November 2024, to 5 January 2025. Throughout this intervention process, all participants from both groups remained fully engaged, with no dropouts at any stage.

(1) Inclusion Criteria: 1) Patients must meet the diagnostic criteria outlined in the “Chinese Anti-Cancer Association Guidelines and Specifications for the Diagnosis and Treatment of BC (2019 Edition)” [21]; 2) Participants must be female, aged between 18 and 65 years; 3) Participants must have undergone a unilateral modified radical mastectomy for BC and have completed either chemotherapy or radiotherapy; 4) All participants must be informed about the study protocol, voluntarily agree to participate, and cooperate with the research process; 5) Patients with motor disabilities are excluded from participation.

(2) Exclusion criteria include: 1) Patients with concurrent malignancies or other acute or chronic diseases; 2) Individuals exhibiting cognitive or communication impairments; 3) Patients diagnosed with severe mental disorders; 4) Patients assessed by physicians as temporarily unsuitable for functional exercise; 5) Individuals with significant health issues that may interfere with behavioral interventions.

(3) Group Settings: 1) The QDG will hold sessions every evening at 6 PM for a duration of 8 weeks, comprising 5 times per week, each lasting 60 min. The Qi Dance course was led by 5 university Qi Dance instructors (professors and associate professors with over 15 years of teaching experience). The training regimen includes a 10-min warm-up, 40 min of Qi Dance practice, and a 10-min relaxation period. Throughout the intervention, Qi Dance instructors will continuously and closely monitor participants’ performance, adjusting the intensity, range of motion, and repetitions as necessary to ensure safe practice. The Qi Dance consists of 12 distinct movements, which include: ‘Two Hands Expanding the Sky’ to regulate the triple energizers, ‘Bird Stretching’, ‘Bird Flying’, ‘Left and Right Starting to Shoot Four Sculptures’, ‘Regulating the Spleen and Stomach’ (lifting one hand alone), ‘Deer Hitting’, ‘Deer Running’, ‘Bear Moving’, ‘Bear Swinging’, ‘Crouching Tiger Pouncing on Food Pose’, ‘Tiger Raising’, and ‘Tiger Raising’ again. These twelve movements are seamlessly integrated with various dance techniques such as walking, turning, and side movements, as well as arm and body postures. Additionally, the dance is accompanied by gentle and soothing music, enhancing the overall experience. This sport is recognized as the 62nd national fitness movement project promoted by the General Administration of Sports of the People’s Republic of China. Before the formal intervention begins, participants will undergo a concentrated 5-day training program. The training will cover basic movement learning, with a focus on familiarizing participants with dance movements and rhythms. Additionally, it will aim to strengthen the foundational actions necessary for practicing Qi Dance. Following the training, all participants will have a 2-day rest period before commencing the formal intervention. During the formal intervention process, the first two weeks primarily focus on practicing combinations of Qi Dance movements, which will be integrated with various dance techniques. Over this period, twelve actions are coordinated with dance and music across a total of 10 classes. From three to seven weeks, participants engage in comprehensive Qi Dance practice, totaling 25 classes. In the eighth week, participants are encouraged to express their creativity and collaborate as a team, culminating in a performance display during the final class, which consists of 5 classes. 2) CG: Adopting health education methods and not engaging in any form of physical activity. The scope of health education encompasses a comprehensive array of knowledge pertaining to both physical and mental well-being. In our study, we provided the CG with education on healthy lifestyles, which

included information on balanced diets, moderate exercise, adequate sleep, and effective stress management. The health education content was disseminated through WeChat groups, with sessions held three times a week. Additionally, we organized a 40-minute online communication and discussion session once a week to address participants' health-related inquiries. Participants were also encouraged to share their health experiences and challenges within the group, fostering a collaborative exploration of solutions. Furthermore, experts were available to promptly respond to participants' questions and messages in the WeChat group. To ensure the quality of the health education content, this study enlisted the expertise of a psychological counseling expert, a nutritionist, and a professor specializing in rehabilitation training.

This study was reviewed and approved by the Ethics Committee of the Liaoning Finance and Trade College (Approval No.: LNCMX20241007). It is essential to inform the research subjects and their families about the purpose, methods, content, significance, potential benefits, and risks associated with the study. Throughout the research process, all participants retain the right to withdraw from the study at any time without any adverse effects on their medical care or nursing. Following the acquisition of consent from both participants and their families, an informed consent form will be duly signed.

2.2. Evaluation indicators

(1) Perceived Stress Scale-10 (PSS-10). The PSS created by Cohen et al. [22], measures how individuals perceive stress in their daily lives over the previous month. It includes 10 questions, each rated on a 5-point scale from 0 (not at all) to 4 (very much). Some items are scored directly (0 to 4), while others are reverse-scored (4 to 0), with total scores ranging from 0 to 40. Higher scores reflect greater perceived stress. Studies have shown that the PSS is reliable, with Cronbach's alpha values usually between 0.78 and 0.91. It has also been widely used in China [23].

(2) Self-rating Anxiety Scale (SAS). The SAS, introduced by Zung in 1971 [24], was designed to measure an individual's self-reported anxiety symptoms. It consists of 20 questions, each rated on a 4-point scale from 1 (none) to 4 (severe). The total score helps determine the level of anxiety: scores below 50 suggest no anxiety, 50–59 indicate mild anxiety, 60–69 reflect moderate anxiety, and scores of 70 or higher point to severe anxiety. Higher scores reflect a greater level of anxiety experienced by the individual [25].

(3) Pittsburgh Sleep Quality Index (PSQI). The PSQI, created by Buysse and colleagues in 1989 [26], measures how well an individual has slept over the past month. It includes 19 questions grouped into seven categories, each scored from 0 to 3. The scores from all categories are added up to give a total PSQI score, which can range from 0 to 21. A higher score indicates worse sleep quality [27].

(4) Functional Assessment of Cancer Therapy - Breast (FACT-B). The FACT-B scale, which uses a validated Chinese version, assesses the quality of life for BC patients during recovery. It includes 36 questions: 27 from the FACT-G and 9 from the BC-specific module (BCS). Each question is scored on a 5-point scale (0 to 4), with total scores typically ranging from 0 to 144. Higher scores indicate a better quality of life [28].

2.3. Statistical analysis

The analysis was conducted using SPSS version 26.0 statistical software. Normality was assessed using the Shapiro Wilk test; if $P > 0.05$, parametric tests were applied; otherwise, non parametric tests were used. The baseline characteristics of BC

patients in the rehabilitation phase were expressed as mean $\pm$ standard deviation ($M \pm SD$) and percentages (%). Paired sample t -tests were utilized to evaluate within-group differences before and after the intervention, while independent sample t -tests were employed to compare between-group differences at both time points. Multiple linear regression analysis was also conducted to explore how the intensity of the Qi Dance intervention affected PSS, SAS, PSQI, and FACT-B scores. A p -value of less than 0.01 was considered statistically significant for all tests.

3. Results

3.1. Patient baseline characteristics

Analysis of the baseline data for both patient groups revealed that the average age was 48.4 ± 6.5 years in the CG and 49.2 ± 6.3 years in the QDG, with no significant difference ($p = 0.63$). The distribution of education levels—elementary, junior high, senior high, and university—was similar between the two groups ($p = 0.83$). Similarly, the proportions of patients in TNM stages I, II, and III were comparable ($p = 0.90$). Daily exercise intensity scores were 1.63 ± 0.67 for the CG and 1.26 ± 0.64 for the QDG, with no significant difference ($p = 0.53$). Overall, the two groups showed no notable differences in age, education level, TNM staging, or daily exercise intensity, confirming that they were well-matched across key characteristics (Table 1).

Table 1. Baseline characteristics of participants.

	CG ($n = 38$)	QDG ($n = 38$)	P
Age ($M \pm SD$)	48.4 ± 6.5	49.2 ± 6.3	0.63
Educational level (%)			0.83
Primary school	16 (26.2)	17 (27.9)	
Junior high school	21 (34.4)	12 (19.7)	
High school	14 (23.0)	19 (31.1)	
University	10 (16.4)	13 (21.3)	
TNM staged			0.90
I	14 (23.0)	12 (19.7)	
II	34 (55.7)	36 (59.0)	
III	13 (21.3)	13 (21.3)	
Regarding daily exercise intensity	1.63 ± 0.67	1.26 ± 0.64	0.53

3.2. Changes in PSS, SAS, PSQI, and FACT-B

In terms of PSS-10, the CG demonstrated a certain degree of change before and after the intervention; however, the magnitude of this change was relatively small (33.50 ± 2.80 vs. 32.76 ± 2.63 , $P > 0.05$). In contrast, the QDG exhibited a more substantial change in psychological stress scores before and after the intervention (32.45 ± 2.82 vs. 15.50 ± 2.79 , $P < 0.05$). A significant difference was noted between the two groups in the post-intervention comparison (32.76 ± 2.63 vs. 15.50 ± 2.79 , $P < 0.05$). In terms of anxiety, as measured by the SAS, there were no significant

differences observed within the CG before and after the intervention, nor between the groups ($P > 0.05$). In contrast, the QDG exhibited significant differences in anxiety levels, both within the group before and after the intervention and when compared to the CG ($60.11 \pm 5.56 > 45.50 \pm 5.09 < 59.13 \pm 5.58$, $P < 0.05$). In terms of the PSQI, the CG exhibited a minor change before and after the intervention; however, this change did not reach statistical significance (16.37 ± 2.82 vs. 15.13 ± 2.75 , $P > 0.05$). Conversely, in the QDG, a significant improvement in sleep quality was observed among BC patients during the rehabilitation period after the intervention, both within the group and in comparison to the CG ($15.50 \pm 2.79/15.13 \pm 2.75$ vs. 7.45 ± 2.74 , $P < 0.05$). In terms of the FACT-B, the CG did not demonstrate a statistically significant difference in scores before and after the intervention (72.08 ± 5.68 vs. 73.00 ± 5.59 , $P > 0.05$). Conversely, the QDG exhibited significant differences both before and after the intervention, as well as in the intergroup comparison post-intervention ($71.00 \pm 5.59/73.00 \pm 5.59 < 126.66 \pm 7.96$, $P < 0.05$). The QDG exhibited significantly greater improvements in the PSS, SAS, PSQI, and FACT-B compared to the CG. This indicates that the Qi Dance intervention has a positive and significant effect on enhancing mental health and quality of life in BC patients during the rehabilitation period (Table 2 and Figure 1).

Table 2. Changes in PSS-10, SAS, PSQI, and FACT-B before and after intervention in both groups.

Index	PSS-10 ($M \pm SD$)		SAS ($M \pm SD$)		PSQI ($M \pm SD$)		FACT-B ($M \pm SD$)		P^1
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
CG	33.50 ± 2.80	32.76 ± 2.63	59.89 ± 5.57	59.13 ± 5.58	16.37 ± 2.82	15.13 ± 2.75	72.08 ± 5.68	73.00 ± 5.59	> 0.05
QDG	32.45 ± 2.82	15.50 ± 2.79	60.11 ± 5.56	45.50 ± 5.09	15.50 ± 2.79	7.45 ± 2.74	71.00 ± 5.59	126.66 ± 7.96	0.01
P^2	0.67	0.01	0.72	0.01	0.43	0.01	0.81	0.01	-

Notes: P^1 : within-group difference. P^2 : between-group difference.

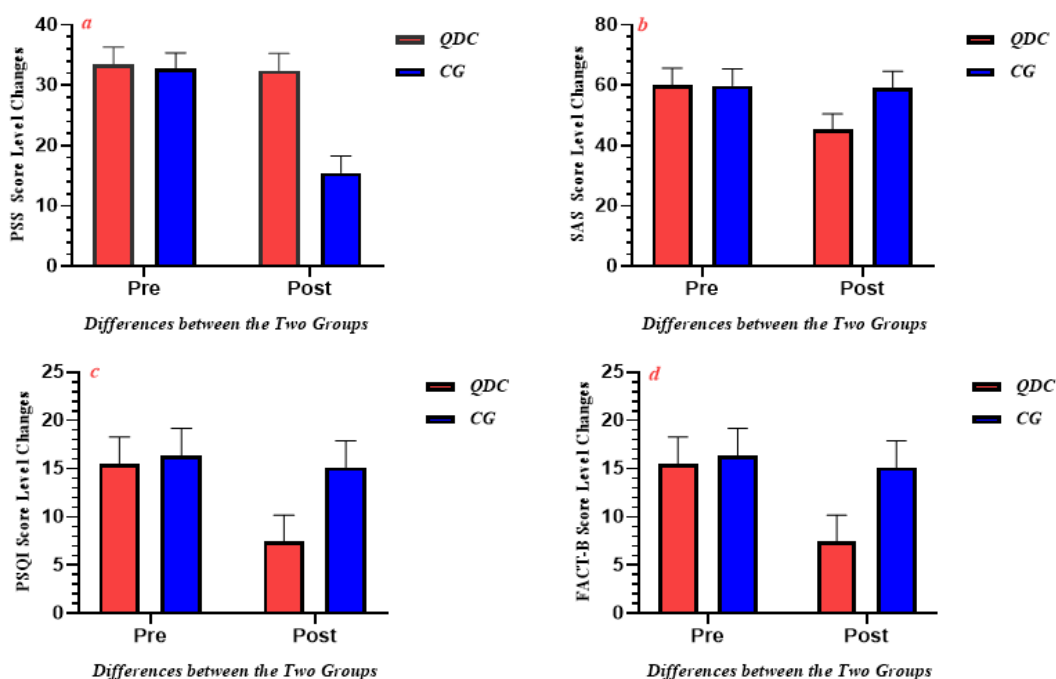


Figure 1. Overall changes in PSS-10, SAS, PSQI, and FACT-B.

3.3. The impact of Qi dance practice intensity on PSS, SAS, PSQI, and FACT-B

The multiple linear regression (Table 3) showed the following results: for PSS-10 ($R^2 = 0.75$, $F = 109.60$, $B = -4.87$, 95% CI $[-5.71$ to $-3.86]$, $p < 0.05$), SAS ($R^2 = 0.72$, $F = 95.96$, $B = -8.57$, 95% CI $[-10.36$ to $-6.80]$, $p < 0.05$), and PSQI ($R^2 = 0.74$, $F = 105.77$, $B = -4.68$, 95% CI $[-5.60$ to $-3.76]$, $p < 0.05$). For FACT-B ($R^2 = 0.82$, $F = 167.29$, $B = 14.26$, 95% CI $[12.03$ to $34.49]$, $p < 0.05$), it was found that, compared to the CG, Qi Dance, at a specific intervention intensity, can significantly reduce stress and anxiety levels in BC patients during the recovery period, improve sleep disorders, and enhance quality of life (Figure 2).

Table 3. The impact relationship between Qi dance intervention and PSS, SAS, PSQI, and FACT-B.

Index	R^2	F	B	Std.Error	t	p	95.0% confidence intervals
PSS-10	0.75	109.60	-4.78	0.45	-10.46	0.01	-5.71 to -3.86
SAS	0.72	95.96	-8.57	0.87	-9.79	0.01	-10.36 to -6.80
PSQI	0.74	105.77	-4.68	0.45	-10.28	0.01	-5.60 to -3.76
FACT-B	0.82	167.29	14.26	1.10	12.93	0.01	12.03 to 34.49

Note: Baseline characteristics, intensity, and fatigue were included as covariates.

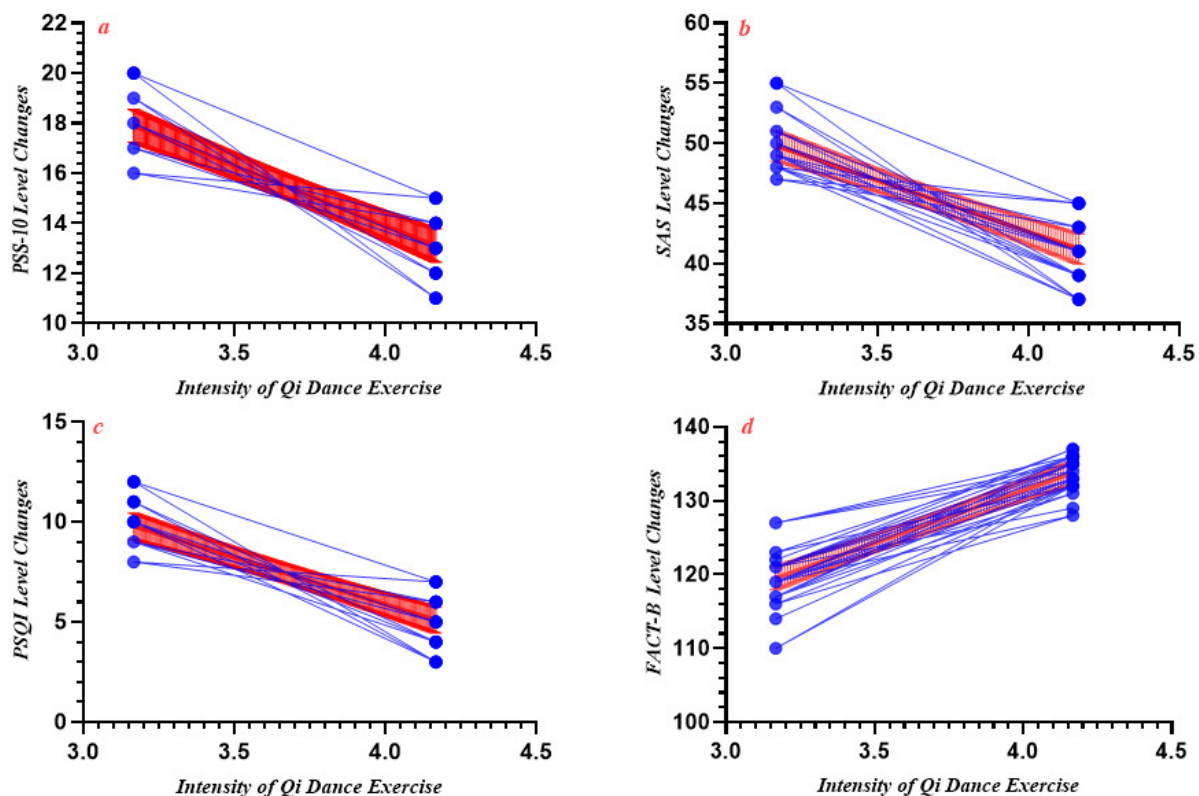


Figure 2. Correlation between Qi dance practice intensity and PSS, SAS, PSQI, and FACT-B.

4. Discussions

This study aimed to investigate the effects of Qi Dance on stress, anxiety, and sleep quality in breast cancer patients during the recovery phase. The results demonstrated that after engaging in Qi Dance exercises, breast cancer patients

experienced alleviation of stress and anxiety, improvement in sleep quality, and enhanced overall quality of life. Incorporating Qi Dance as a non-pharmacological alternative therapy into the treatment framework for psychological issues in breast cancer recovery patients not only provides an intervention option but also expands the scope of research on non-pharmacological interventions for alleviating symptoms in breast cancer survivors and other cancer populations.

We found that Qi Dance, in addition to its athletic attributes, is characterized by its bodily artistic expression and bidirectional social interaction. On one hand, showcasing physical aesthetics and diverting attention helps patients reduce negative emotions, achieve psychological relaxation, alleviate internal stress, thereby enhancing psychological resilience and alleviating anxiety [29,30]. On the other hand, Qi Dance effectively promotes communication and interaction among patients during the rehabilitation period, bridging interpersonal distances and facilitating the establishment of positive relationships [31]. Such interpersonal connections provide an effective platform for emotional expression, strengthen a sense of belonging and identity, and play a significant role in reducing anxiety, relieving stress, improving sleep quality, and enhancing overall quality of life—findings consistent with those from interpersonal therapy research [32,33].

The improvement of sleep disorders represents another significant finding of this study. Sleep disturbances in breast cancer patients are typically closely associated with psychological stress, anxiety, and treatment-related side effects [34,35]. From a physiological perspective, Qi Wu—a practice combining abdominal breathing, rhythmic movements, and limb stretching—activates the parasympathetic nervous system, stimulates proprioceptors to transmit stabilizing signals to the brain, and inhibits excessive sympathetic nervous system excitation, thereby promoting nervous system relaxation [36,37]. Additionally, it reduces lactate accumulation, enhances flexibility and coordination, and facilitates physical and mental relaxation [38, 39]. Furthermore, this exercise modality lowers cortisol levels, activates the brain's reward system, and promotes the release of endorphins, dopamine, and serotonin, thereby comprehensively improving stress, anxiety, and sleep quality [40]. These physiological effects are consistent with previous research findings [41,42].

However, the most significant distinction of this study from previous research lies in its further analysis of the relationship between aerobics and psychological stress, anxiety, sleep, and quality of life in breast cancer patients during the recovery phase from the perspective of exercise intensity. This provides a substantial supplement to the long-standing lack of in-depth research on intervention intensity.

Although Qi Dance intervention demonstrates the aforementioned positive outcomes, it also possesses certain limitations. Firstly, the sample size is relatively limited, and there is a lack of long-term follow-up, which to some extent restricts the representativeness and generalizability of the results. Secondly, self-rated scales are susceptible to subjective bias. Thirdly, variables such as age, ethnicity, and cancer stage were not controlled for, nor were subgroup analyses or power analyses conducted to determine an appropriate sample size. Fourthly, the intervention and observation periods were short, and objective neurophysiological and psychometric indicators were lacking, which impedes a deeper exploration of underlying mechanisms and the evaluation of the intervention's sustainability. Future research should address these shortcomings by expanding the sample size, incorporating power analyses and subgroup analyses, conducting long-term follow-ups, and utilizing objective metrics such as cortisol levels, heart rate variability, and polysomnography.

Additionally, randomized controlled trials comparing Qi Dance with other non-pharmacological interventions (e.g., yoga, Tai Chi, cognitive behavioral therapy) should be conducted to further validate its rehabilitation efficacy and optimal strategies.

5. Conclusions

This research contributes new evidence to the field of mind-body interventions. It is the first study to clearly elucidate the effects of Qi Dance on patients with breast cancer during their rehabilitation period, confirming its efficacy as a mind-body intervention. This discovery further enhances the theoretical foundations of cancer rehabilitation. Although the study has certain limitations, Qi Dance, as a novel mind-body intervention method, possesses unique advantages and significant potential. It introduces a fresh perspective to the research on mind-body interventions and expands the scope and boundaries of this field. For patients undergoing rehabilitation from breast cancer, Qi Dance offers a new rehabilitation option and exercise approach, enabling patients to explore more diverse strategies during their recovery process. We anticipate that Qi Dance will play an increasingly significant role in breast cancer rehabilitation, providing substantial well-being benefits to patients. Based on these findings, we propose the following recommendations: it is essential to consider integrating Qi Dance into the healthcare system. With the standardization and promotion of this practice, more patients will be able to benefit. Individualized Qi Dance intervention plans should be developed based on patients' specific physical conditions and rehabilitation stages to enhance the relevance and effectiveness of interventions. Additionally, strengthening professional training for Qi Dance instructors is crucial to ensure the scientific validity and safety of the intervention process. Furthermore, combining Qi Dance with other alternative therapies and exploring the effects of collaborative interventions could provide more comprehensive and diversified programs for breast cancer rehabilitation treatment.

Author contributions: Conceptualization, FW, JY and HT; methodology, ZW, JL, and HT; software, ZW, JL and FW; validation, FW, JY and HT; formal analysis, ZW, JL and JY; investigation, ZW, JL and HT; resources, ZW, JL and FW; data curation, ZW, JL and FW; writing—original draft preparation, ZW, JL and FW; writing—review and editing, ZW, JL and HT; visualization, ZW, JL and FW; supervision, FW, JY and HT; project administration, FW, JY, and HT; funding acquisition, FW. All authors have read and agreed to the published version of the manuscript.

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Data availability: The participants of this study did not agree to their data being shared publicly; therefore, supporting data are not available.

Ethical approval: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the Liaoning Finance and Trade college (Approval No.: LNCMXY20241007). All participants signed an electronic version of the informed consent form.

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Conflict of interest: The authors declare no conflict of interest.

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