A systematic review and meta-analysis of the effects of muscle relaxation training *vs.* conventional nursing on the depression, anxiety and life quality of patients with breast cancer

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Background: Muscle relaxation training is a method of gradually relaxing the whole body by consciously controlling the process of muscle contraction and relaxation, which is mostly used to improve the physical and mental health of breast cancer patients and improve the quality of life of patients. We conducted a systematic review to compare the effects of muscle relaxation training and conventional nursing on the psychological health and quality of life (QoL) of breast cancer patients. The results of this study provide a basis for nursing program selection of breast cancer patients.

Methods: The PubMed, EMbase, Web of Science, The Cochrane Library, China national knowledge infrastructure (CNKI), WanFang Data, (China Biology Medicine disc) CBM, and WWW.CQVIP.COM (VIP) databases were searched to retrieve articles on randomized controlled trials (RCTs) or quasi-RCTs on the effects of muscle relaxation training on the mental health and QoL of breast cancer patients. The search period ran from the establishment of the databases to August 31st, 2021. Two researchers independently screened the literature, extracted the data, and The Cochrane Handbook for Systematic Reviews of Interventions assessed the risk of bias in the included studies. Stata 15.0 software was then used for the meta-analysis.

Results: Funnel plots were analyzed by E Egger's test and Begg's test. The results of the test (P>0.05) showed that the possibility of publication bias was small. A total of 13 RCTs and quasi-RCTs, comprising 1,355 patients, were included in the meta-analysis. The results for the outcome measures were as follows: level of depression [weighted mean difference (WMD) =−9.31, 95% confidence interval (CI): −11.96 to −6.65, level of anxiety (WMD =−8.96, 95% CI: −10.06 to −7.86)], and QoL (WMD =13.13, 95% CI: 7.24, 19.02). The results showed that muscle relaxation training can significantly reduce depression and anxiety in breast cancer patients, improve their quality of life, and can be used as the first choice for breast cancer patients to improve negative emotions.

Discussion: Muscle relaxation training significantly reduced the depression and anxiety of breast cancer patients, improved their QoL, and brought about both psychological and QoL improvements.

Keywords: Breast cancer; muscle relaxation training; meta-analysis; quality of life (QoL); psychological health

Introduction

Among the cancers that threaten the health and lives of women, breast cancer ranks first in the world (1). Indeed, the incidence of breast cancer ranks first in most countries (i.e., in 159 of 185 countries) (1). China has the highest incidence of (17.6%), and mortality rate (15.6%) for, female breast cancer in the world (2). With advancements in diagnosis and treatment, the survival rate of breast cancer patients is increasing year by year, but the 5-year survival rate is still as high as 90% (3). Thus, while the life expectancy of breast cancer patients has been prolonged, patients with breast cancer are prone to anxiety, depression, fatigue, and other psychological problems during treatment, which also affect their quality of life (QoL) (4,5).

QoL has become an important criteria for evaluating the overall treatment of cancer. Depression and anxiety are common complications among breast cancer patients. Study has shown that depression and anxiety negatively affect the treatment, relapse, and all-cause mortality of breast cancer patients (6). Thus, improving patients' psychological state to increase the cure rate has become a popular area of clinical research (7).

Patients with breast cancer have expressed more and more interest in using complementary and integrative therapies as supportive care to restore their physiological functions and adjust their mental state (8,9). Complementary and comprehensive therapies include a variety of activities, such as relaxation approaches, meditation, deep breathing, guided imaging, and stress management interventions (10). Muscle relaxation training is an economical and convenient intervention method. Progressive relaxation training is the most commonly used relaxation training method at present, which has the characteristics of strong operability, good application effect and easy acceptance. Patients through conscious control of the body muscle repeated contract-relaxation cycle process, to achieve the effect of gradual relaxation of the whole body (11,12). However, there is insufficient evidence to support the use of muscle relaxation training in an oncology setting.

Complementary and integrative therapies are becoming more and more commonly used in medical practice, and muscle relaxation training is one of the most promising integrative breast cancer treatments. However, at present, this therapy has been applied in coronary heart disease, diabetes, hypertension, asthma, myocardial infarction and other acute and chronic diseases, which has been proved to help patients reduce negative emotions and improve their quality of life to a certain extent. But the study concluded that the treatment did not work as well as expected in breast cancer patients

This study conducted a systematic review and meta-analysis based on randomized controlled trials (RCTs) or quasi-RCTs to evaluate the effects of muscle relaxation training on the psychological health and QoL of breast cancer patients. This study sought to provide evidence for choosing active care in clinical practice to produce improvements in the psychological state and QoL of breast cancer patients.

We present the following article in accordance with the PRISMA reporting checklist (available at https://tcr.amegroups.com/article/view/10.21037/tcr-22-428/rc).

Methods

Inclusion criteria for study selection

Types of studies
Only RCTs or quasi-RCTs were included in the meta-analysis.

Types of objects
Only published RCTs or quasi-RCTs with data comparing relaxation training to regular nursing among patients with breast cancer were considered for inclusion in the meta-analysis. For the study selection, all gray literature was excluded.

Intervention measures
The intervention measures of the experimental group were muscle relaxation training, which is a relaxation training method. It is a method to gradually relax the whole body by consciously controlling the process of muscle contraction and relaxation, including yoga, progressive muscle relaxation training and relaxation training. In contrast, for the control group, the intervention was routine care.

Outcome measures
The outcome measures were as follows: (I) depression; (II) anxiety; and (III) QoL. Depression, anxiety, and QoL were continuous effect measures, and the effect size was the variation from the baseline to the follow-up time.

Study exclusion criteria

Articles were excluded from the meta-analysis if they met

any of the following exclusion criteria: (I) was about a non-RCT or non-retrospective research, such as in-vitro experiments, reviews, abstracts, or letters; (II) the study did not include a control group or included an inconsistent control group; (III) was published in a language other than Chinese or English; (IV) the original text of the article could not be obtained; (V) the study included <20 samples; and/or (VI) the data could not be obtained or converted.

Literature screening methods

In this study, 2 of the authors independently searched the following databases: PubMed, EMbase, Web of Science, The Cochrane Library, CNKI, WanFang Data, CBM, and VIP to retrieve articles on RCTs examining the effects of muscle relaxation training on the psychological health and QoL of breast cancer patients. The systematic searches were carried out from the establishment of the databases to August 31st, 2021. Additionally, the reference lists of any review articles were also reviewed to supplement the relevant literature. The search strategy combined theme words and free words. Among them, the PubMed search theme terms included breast Neoplasms [Mesh] and Muscle Relaxation [Mesh], and the Chinese search terms included breast neoplasms, mammary carcinoma, breast cancer, breast tumor, muscle relaxation, etc.

Study selection and data extraction

Next, the 2 authors independently screened the literature, extracted the data, and cross-checked the data. Any disagreement between the reviewers was resolved by discussion or consulting a third party. When selecting the literature, the reviewers first read the title and abstract, and then excluded any irrelevant articles. Next, they read the full text of the remaining articles to determine inclusion/exclusion. If necessary, the reviewers contacted the corresponding authors via email or telephone for detailed information that had not yet been confirmed but was crucial for this research.

The following information was extracted: (I) basic information about the included article, including the title, the first author's name, date of publication, country, and region; (II) the baseline characteristics of the research objects, including the sample size, age, education status, marriage, and clinical stage; (III) the intervention and control measures, including the muscle relaxation training methods, period, frequency, and duration; (IV) the included standard outcome measures and related results; and (V) the

relevant information on the bias-risk evaluations.

Risk of bias assessment

Risk of bias assessments were conducted by the 2 reviewers independently, and the results were cross-checked. If any inconsistences arose in the process, a third reviewer was consulted to resolve the disagreement. The risk of bias assessment was conducted by applying the tools for risk of bias assessment recommended by the *Cochrane Handbook for Systematic Reviews of Interventions* (13), which include the 7 items were designed from the following 6 aspects: (I) selection bias (e.g., random-sequence generation, and allocation-result concealment); (II) implementation bias (e.g., the patient-blinding method); (III) measurement bias (e.g., the result evaluator blinding method); (IV) loss to follow-up bias (e.g., incomplete data); (V) reporting bias (e.g., selective-result reporting); and (VI) other possible biases. Each item was classified as "high risk", "low risk", or "unclear" for the bias-risk assessment results.

Outcome measures

The outcome measures of this meta-analysis were as follows: (I) the level of depression as assessed by the Self-Rating Depression Scale (SDS) compiled by Zung (14); (II) the level of anxiety as assessed by the Self-Rating Scale (SAS) compiled by Zung (14); (III) QoL as evaluated by the Functional Assessment of Cancer Therapy developed by the Center on Outcomes Research and Evaluation (15); and (IV) the QoL Measurement Scale for Breast Cancer Patients (FACT-B), which is a specific scale composed of FACT-G and breast cancer-specific modules for breast cancer patients.

Statistical analysis

Stata 15.0 software was used for the statistical analysis. In this meta-analysis, the level of depression, the level of anxiety, and the QoL were continuous effect indicators, and the dimensions of each study were unified. Thus, the combined effect size was determined by the weighted mean difference (WMD), which is expressed with the 95% confidence interval; that is, WMD (95% CI). The Q test and I^2 test were used to determine the extent of heterogeneity. When $I^2<50\%$ or $P<0.1$, the fixed-effects model was used to combine the outcome measures; and when $I^2\geq50\%$ or $P<0.1$, indicating statistical heterogeneity
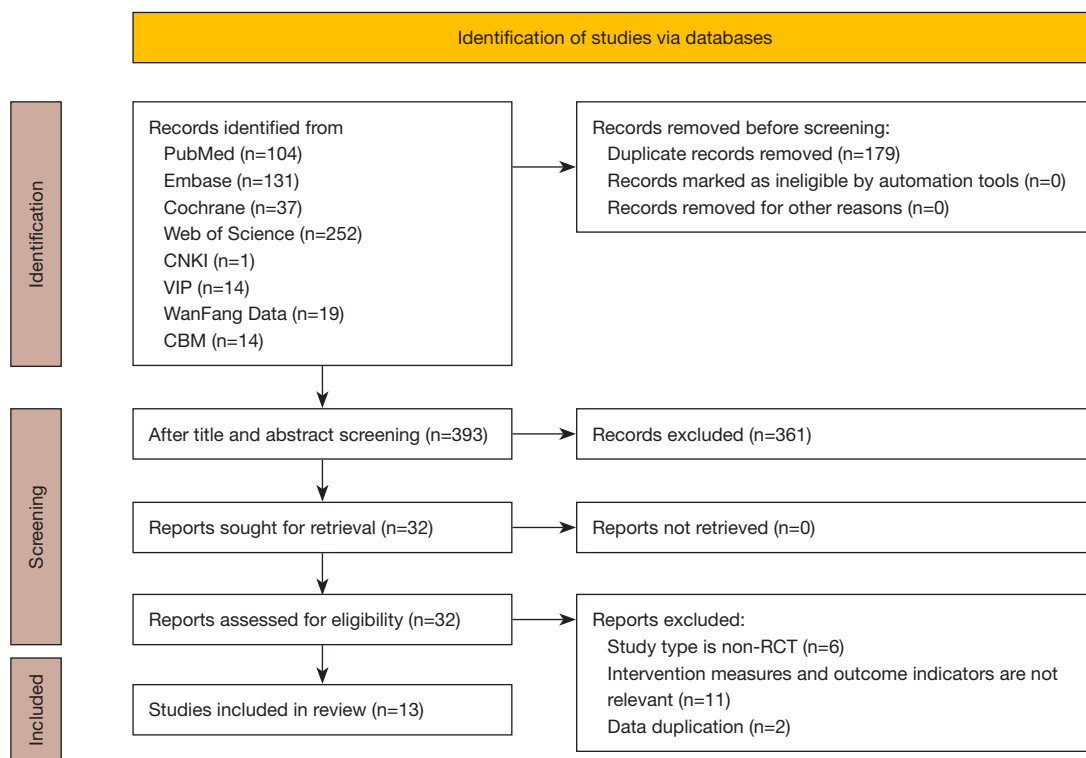
Figure 1 Article selection process and results.

among the results, we analyzed the source of heterogeneity and excluded the influence of any obvious clinical heterogeneity, and then used the random-effects model.

When $I^2 \geq 50\%$, clinical heterogeneity was analyzed by a subgroup analysis or sensitivity analysis. The publication bias of the included studies was displayed in a funnel chart, and the Begg's test and Egger's test were used to analyze the funnel chart. In this study, for the Begg's test and Egger's test, a P value <0.05 indicated a statistically significant difference.

Results

Article selection process and results

In total, 572 studies were retrieved, and after review, 13 RCT or quasi-RCT trials, comprising a total of 1,355 patients, were finally included in the meta-analysis (11,16-27). The article screening process and results are shown in *Figure 1*.

The basic characteristics of the included studies and the results of the risk assessment of bias

The included studies were published from 2005 to

2021, and comprised a total of 1,355 patients (679 in the experimental group and 676 in the control group) (17,21,25). Of the articles, 3 were quasi-RCTs. A random sequence was generated in the order of admission time (17). One study was an open-label trial. The basic characteristics of the included articles are set out in *Table 1*.

The results of the risk of bias assessment are shown in *Table 2*, *Figure 2*, and *Figure 3*. In the studies included in the meta-analysis, the risk of sequence generation and allocation of the 11 articles was low (21,25). The 2 studies that generated random sequences in the order of odd and even numbers and admission time had a high risk of bias. In general, the risks of implementation bias and detection bias were low. All the studies were feasible, and the outcome of the scheme was consistent with the results of the study.

Results of the meta-analysis

Depression degree

Of the included studies, 6 (21,23-27) (comprising a total of 949 patients) reported on the effects of muscle relaxation training on the level of depression of patients. A random-effects model was adopted ($I^2=84.6\%$, P=0.000), and the

Table 1 Basic characteristic of the included studies

Study	Country	N (T/C)	Intervention T	Intervention C	Cure time	Marital status T [N]	Marital status C [N]	Age (T/C) (year, mean ± SD)	Education level T [N]	Education level C [N]
Kovačič Tine 2011 (16)	Slovenia	16/16	Yoga + routine care	Routine care	4 weeks	Single [1], married [11], widowed [3], divorced [1]	Single [0], married [13], widowed [2], divorced [1]	50.1±9.37/ 50.1±8.31	High school [8], college [8]	High school [8], college [8]
Demiralp Meral 2010 (11)	Turkey	14/13	PMRT + routine care	Routine care	8 sessions		58 [48–75]/ 55 [40–73]			
Kurt Berna 2018 (17)	Turkey	25/24	Relaxation exercises	Routine care	8 times	Single [7], married [18]	Single [5], married [19]	50.7±9.1/ 52.4±10.0	Primary school [10], elementary school [4], high school [6], college or more [5]	Primary school [11], elementary school [5], high school [4], college or more [3]
Pruthi Sandhya 2012 (18)	USA	15/15	Yoga	Routine care	8 weeks		42.91±10.1 /44.00±7.2			
Vuttanon Nuttamon 2019 (19)	Thailand	48/48	PMRT	Routine care		Single [16], married [27], widowed [5]	Single [5], married [35], widowed [8]		None [1], primary school [18], secondary school [7], college or more [22]	None [2], primary school [15], secondary school [14], college or more [17]
Yoo Hee J 2005 (20)	South Korea	30/30	PMRT + GI	Routine care	6 sessions	Single [3], married [25], widowed [2]	Single [2], married [26], widowed [2]		11.9±3.2 (year, mean ± SD)	11.67±4.8 (year, mean ± SD)
Chun-Li Song 2019 (27)	China	30/30	Relaxation exercises	Routine care	5 weeks					
Linnan Yuan 2017 (26)	China	100/100	PMRT	Routine care	5 weeks		47.59±10.62/ 48.61±10.35			
Xu-Yan Xi 2019 (25)	China	43/43	PMRT + routine care	Routine care	5 weeks					
Min Chen 2021 (21)	China	51/52	PMRT + routine care	Routine care	6 weeks			47.2±2.5/ 47.1±3.1	Junior high school and below [12] high school [24] junior college or more [15]	Junior high school and below [14] high school [21] junior college or more [17]
Ningrui Hou 2017 (23)	China	200/200	PMRT + routine care	Routine care	5 weeks		52.5±2.2/ 52.4±1.6			
Wei Jiao 2016 (24)	China	50/50	PMRT + routine care	Routine care	4 weeks					
Yuhua Liu 2020 (22)	China	57/55	PMRT + routine care	Routine care	5 weeks					

N, number of cases; T, Trial group, C, Control group; PMRT, progressive muscle relaxation training; GI, guided imagery; SD, standard deviation.

Table 2 Results of risk of bias assessment

Study	v1	v2	v3	v4	v5	v6	v7
Kovačič Tine 2011 (16)	Low	Low	Low	Low	Low	Low	Unclear
Demiralp Meral 2010 (11)	Unclear	Unclear	Unclear	Unclear	Low	Low	Low
Kurt Berna 2018 (17)	Unclear	High	Unclear	Unclear	Low	Low	Low
Pruthi Sandhya 2012 (18)	Unclear	Unclear	Unclear	Unclear	Low	Low	Low
Vuttanon Nuttamon 2019 (19)	Unclear	Unclear	Unclear	Unclear	Low	Low	Low
Yoo Hee J 2005 (20)	Unclear	Low	Unclear	Unclear	Low	Low	Unclear
Chun-Li Song 2019 (27)	Low	Unclear	Unclear	Unclear	Low	Low	Unclear
Linnan Yuan 2017 (26)	Low	Unclear	Unclear	Unclear	Low	Low	Unclear
Xu-Yan Xi 2019 (25)	High	Unclear	Unclear	Unclear	Low	Low	Unclear
Min Chen 2021 (21)	High	Unclear	Unclear	Unclear	Low	Low	Unclear
Ningrui Hou 2017 (23)	Low	Unclear	Unclear	Unclear	Low	Low	Unclear
Wei Jiao 2016 (24)	Unclear	Unclear	Unclear	Unclear	Low	Low	Unclear
Yuhua Liu 2020 (22)	Unclear	Unclear	Unclear	Unclear	Low	Low	Unclear

v1-v7 shows random-sequence generation, allocation concealment, performance blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other bias.

combined results showed that the difference between the 2 groups was statistically significant (–9.31, 95% CI: –11.96, –6.65). Thus, muscle relaxation training for the adjuvant treatment of breast cancer patients was significantly better than conventional care in terms of reducing depression (see *Figure 4A*).

A subgroup analysis was carried out according to the study types, and the results showed that the heterogeneity mainly originated from 2 quasi-RCTs, and there was a large heterogeneity between the quasi-RCTs and RCTs.

For the outcome measure of depression, we used a funnel chart to demonstrate the publication bias, and the Egger's test and Begg's test to analyze the funnel chart. The results of the tests (P>0.05) indicated that the possibility of publication bias was small. Additionally, the sensitivity analysis results showed that the effect size after excluding each study did not change significantly (see *Figure 4B,4C*).

Anxiety

Of the included studies, 6 (21,23-27) (comprising a total of 949 patients) reported on the effects of muscle relaxation training on the anxiety of patients. A fixed-effects model was adopted (I^2=5.6%, P=0.381), and the combined results showed that the difference between the 2 groups was statistically significant (WMD =–8.96, 95% CI: –10.06,

–7.86). Thus, muscle relaxation training adjuvant therapy for breast cancer patients was significantly better than conventional nursing in terms of reducing anxiety (see *Figure 5A*).

For the outcome measure of anxiety, we used a funnel chart to display the publication bias, and the Egger's test and Begg's test to analyze the funnel chart. The results of the tests (P>0.05) indicated that the possibility of publication bias was low. Additionally, the sensitivity analysis results showed that the effect size after excluding each study did not change significantly (see *Figure 5B,5C*).

QoL

Of the included studies, 8 (18,20,21,23-27) (comprising a total of 1,039 patients) reported on the effects of muscle relaxation training on patients' QoL. A random-effects model was adopted (I^2=97.2%, P=0.000), and the combined results showed that the difference between the 2 groups was statistically significant (WMD =13.13, 95% CI: 7.24, 19.02). Thus, muscle relaxation training treatment was significantly better than conventional care in improving the QoL of breast cancer patients (see *Figure 6A*).

A subgroup analysis was carried out according to the study type, and the results showed that the heterogeneity

554

Fang et al. Muscle relaxation vs. conventional nursing with breast CA
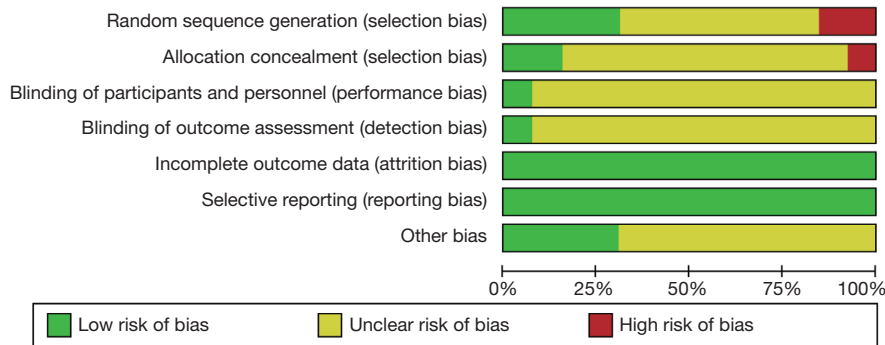
mainly originated from 2 quasi-RCTs, and there was a large heterogeneity between the quasi-RCTs and RCTs.

For the outcome measure of QoL, we used a funnel chart to display the publication bias, and used the Egger's test and Begg's test to analyze the funnel chart. The results of the tests (P>0.05) indicated that the possibility of publication bias was low. Additionally, a sensitivity analysis was carried out by excluding individual studies one by one. The results showed that this study (25) had a great impact on the results, which may be related to the high risk of random allocation of odd and even numbers. However, after excluding the above study, the combined analysis results showed no fundamental changes, indicating that the results of the meta-analysis were relatively stable (see *Figure 6B,6C*).

Discussion

We conducted a meta-analysis of RCTs and quasi-RCTs to examine the effects of muscle relaxation training on the mental health and QoL of breast cancer patients compared to conventional care. In total, 13 RCTs and quasi-RCTs, were included in the meta-analysis. The results showed that compared to conventional care, muscle relaxation training significantly reduced the level of depression and level of anxiety of breast cancer patients, and improved their QoL.

With advancements in diagnosis and treatment, the life span of breast cancer patients has been prolonged, but studies have shown that nearly 50% of breast cancer patients suffer from psychological distress during diagnosis and treatment or recovery, which seriously affect their QoL (5,28). Thus, more attention needs to be paid to patients' QoL during and after cancer treatment. It is necessary to explore an effective way to intervene in patients' psychological health and quality of life to improve
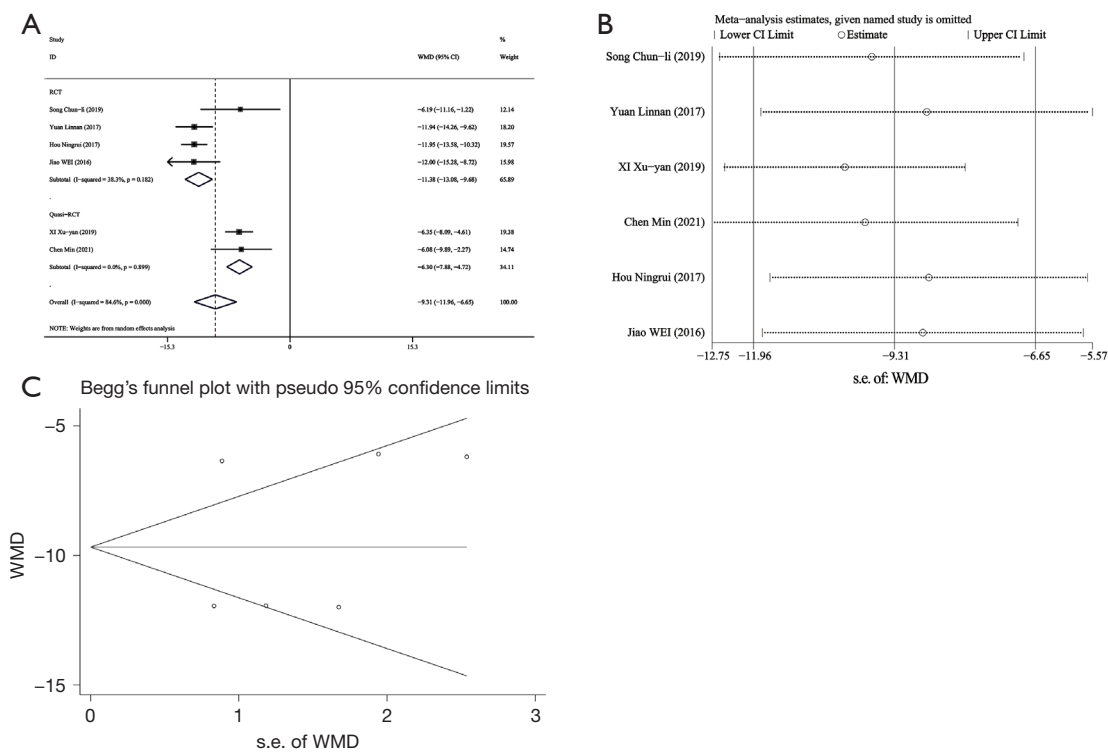

Figure 2 Summary of risk of bias.

Figure 3 Chart of risk of bias.

Figure 4 Analysis of depression. WMD, weight mean difference; s.e. of: WMD, standard error of weighted mean difference.
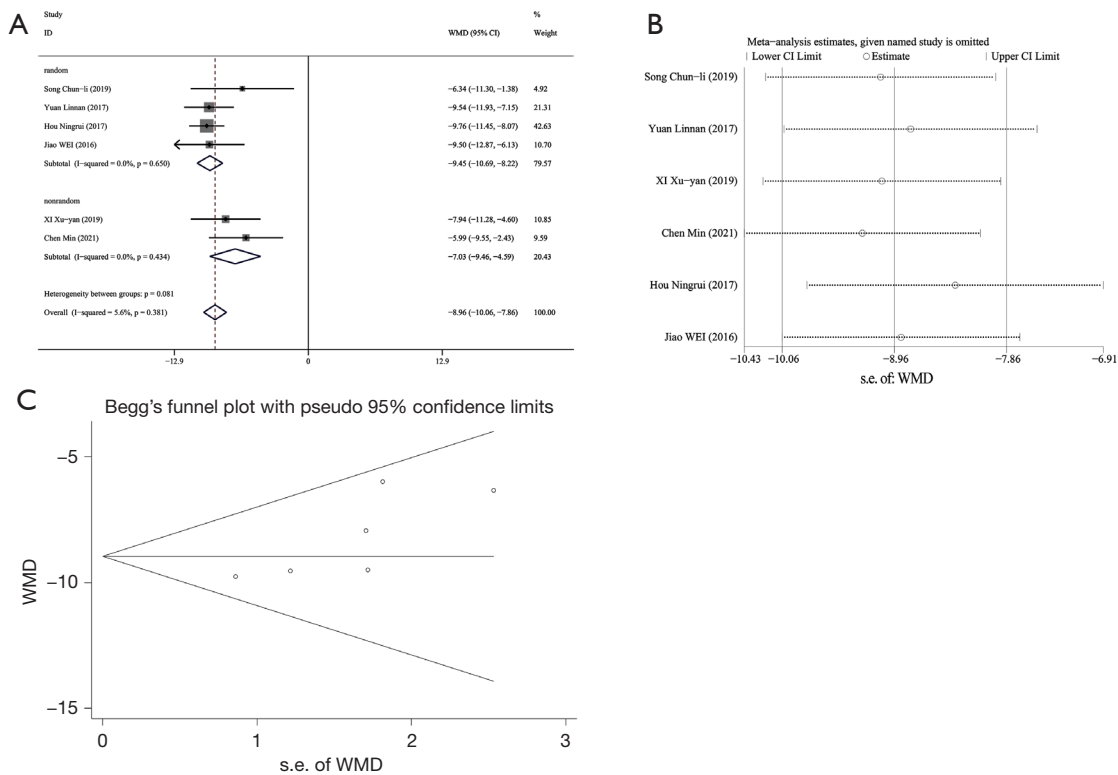

Figure 5 Analysis of anxiety. WMD, weight mean difference; s.e. of: WMD, standard error of weighted mean difference.

556

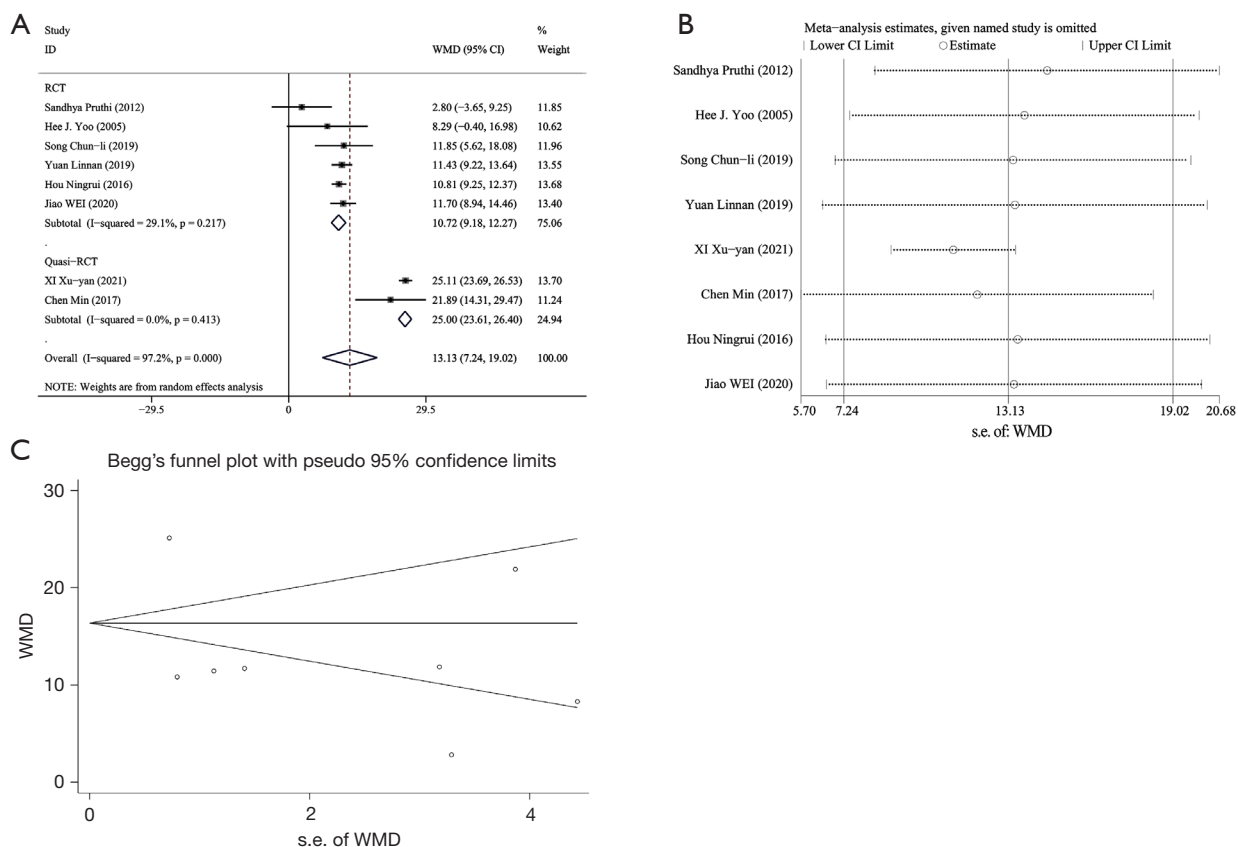*Fang et al. Muscle relaxation vs. conventional nursing with breast CA*

Figure 6 Analysis of QoL. QoL, quality of life. WMD, weight mean difference; s.e. of: WMD, standard error of weighted mean difference.

their QoL. Thus, we used depression, anxiety, and QoL as the outcome measures in this meta-analysis to examine the effect of conventional nursing and muscle relaxation training on patients' mental health and QoL.

The latest meta-analysis published by Ramírez-Vélez *et al.* (29) confirmed that exercise moderately improved the QoL of breast cancer patients, and also slightly improved different aspects, such as anxiety, body shape and appearance, depression, overall QoL, and emotional function. It also pointed out the limitations of related meta-analysis research, including the lack of evidence for some important outcome measures, and the limitation of the method of RCT. The meta-analysis of Yi *et al.* (30) showed that yoga may help to reduce fatigue, depression and anxiety, improve sleep disorders, and improve the QoL of breast cancer patients receiving short-term chemotherapy. However, due to the inconsistent control group in the study, it is not yet clear whether yoga has a significant advantage over other treatments. Notably, our research was based on RCTs and quasi-RCTs, and we found that muscle relaxation

training significantly improved the level of depression and the level of anxiety of patients and improved their QoL compared to conventional care, and thus improved patients' management of bad emotions and their QoL.

However, this study still had some limitations. First, while we conducted a comprehensive search of mainstream databases, there are still a few RCTs that could have been included in this meta-analysis. Second, the collection of characteristic factors was limited, and the history of abortion, history of contraception, history of benign breast diseases, and other clinical factors and basic demographic characteristics were not examined.

In summary, this study has important clinical significance. It emphasizes the importance of a more systematic screening of breast cancer patients' anxiety, depression, and QoL. It also emphasizes the necessity of using muscle relaxation training in breast cancer care to improve patients' mental health and QoL. Our findings can be used by oncologists, cancer nurses, and physical therapists, and provide a reference for future cancer rehabilitation management.

Conclusions

Based on the limited evidence, compared to conventional care, muscle relaxation training significantly reduces the level of depression and level of anxiety of breast cancer patients and improves their QoL. This meta-analysis was limited by the number and the quality of the included studies. The above conclusions need to be verified by larger-scale and multi-center investigations, using more accurate and high-quality studies.

Footnote

Reporting Checklist: The authors have completed the PRISMA reporting checklist. Available at https://tcr.amegroups.com/article/view/10.21037/tcr-22-428/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tcr.amegroups.com/article/view/10.21037/tcr-22-428/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work, including ensuring that any questions related to the accuracy or integrity of any part of the work have been appropriately investigated and resolved.

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558

Fang et al. Muscle relaxation vs. conventional nursing with breast CA

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