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Combined Exercise is Best Exercise Modality to Improve Quality of life in Breast Cancer Survivors: A Systematic Review and Meta-Analysis

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* Correspondence: fenghong0313@163.com; Tel.: +86-178-5717-8772 **Abstract:** A single paragraph of about 100 words to give a brief introduction to your work

Abstract: Globally, breast cancer is the most common cancer in women, posing a serious threat to women's health. We investigated the different types of exercise(aerobic exercise (AE), resistance exercise (RE), and combined aerobic and resistance exercise (CO)) to increase the quality of life (QoL) in breast cancer patients. Meta-analysis was used to estimate the effect sizes, and subgroup analyses were conducted based on types of exercise. The inclusion criteria were met by 28 studies (31 trials), comprising 2038 patients for exercise (n = 1039) and control (n = 999). Meta-analysis showed exercise intervention enhanced QoL (0.44; 95% CI: 0.26–0.62) in patients with breast cancer. Subgroup analysis revealed CO (0.97; 95% CI: 0.33–1.61) was better than AE (0.42; 95% CI: 0.17–0.67) and RE (0.13; 95% CI: −0.05–0.31) in increasing QoL in patients. In conclusion, exercise intervention has a positive impact on the QoL of breast cancer patients. The most appropriate type of exercise to improve QoL is probably CO.

Keywords: Breast Cancer； Quality of Life; Aerobic Exercise; Resistance Exercise; Exercise Rehabilitation

1. Introduction

Globally, breast cancer is the most common cancer in women, posing a serious threat to women's health. About 2.1 million new cases of breast cancers were diagnosed in 2018, accounting for one quarter of cancer cases in women[1]. Fortunately, owing largely to early detection and the development of medical technology, the survival rate of breast cancer patients after treatment is increasing[2]. However, the treatment of cancer produces a series of side effects (e.g., nausea, pain, insomnia, and limited limb movement), which seriously affect the quality of life (QoL) of cancer patients [3,4].

As a physical therapy, exercise has been included in the rehabilitation of breast cancer patients. Previous studies have shown that exercise intervention can change patients' body composition, enhance muscle strength, regulate mood, and increase QoL [5,6]. However, It is not clear which type of exercise is better for increasing the QoL of breast cancer patients. A meta-analysis of 25 RCTs found that a single type of exercise intervention, such as aerobic, yoga, or qigong, is more conducive to improving the QoL of breast cancer patients than combined aerobic resistance exercise [7]. An RCT on exercise and breast cancer patients reported that there was no difference between aerobic exercise (AE) and combined aerobic and resistance exercise (CO) in improving the QoL of breast cancer patients [8]. Another RCT indicted that resistance exercise (RE) and AE have the same effect on improving the QoL of breast cancer patients[9].

Therefore, the main purpose of this systematic review and meta analysis was to evaluate the efficacy of the different types of exercise intervention on the QoL of breast cancer patients.

2. Materials and Methods

2.1. Search strategy

The electronic databases we used to search for literature included PubMed, ScienceDirect, Google Scholar and Web of Science. We conducted the electronic search form database inception to November 2020. The search terms included "breast cancer" OR "breast tumor" OR "breast neoplasms" AND "sports" OR "physical activity" OR "exercise" OR "aerobic exercise" OR "resistance exercise" AND "quality of life" OR "QoL".

3. Results

3.1. Study Searching and Selection

Through a systematic search, a total of 1605 studies were identified. After removing duplicates, 764 studies remained. After reading titles and abstracts, 662 articles were excluded, and 102 potentially relevant studies remained. Finally, we checked the 102 full texts, removed 74 articles, and included 28 studies (31 trials) in our meta-analysis (Figure 1).

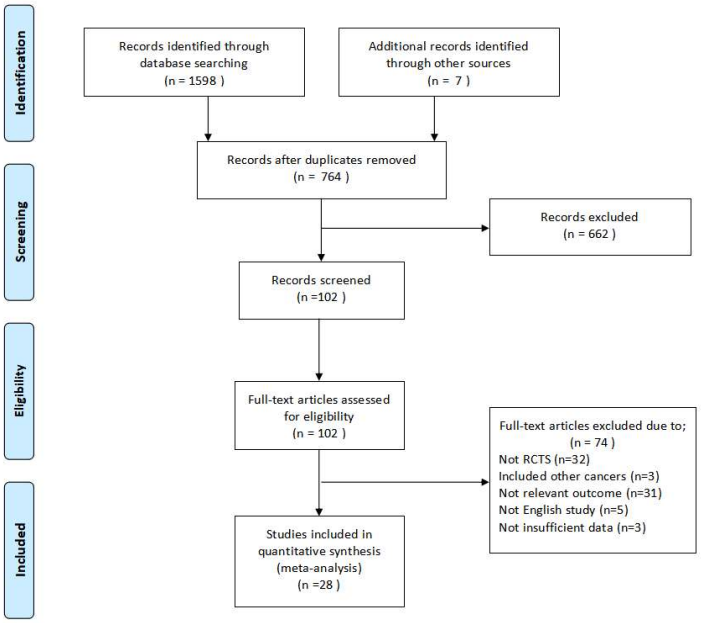

Figure 1. Flow chart of literature search.

3.2. Study Characteristics

The detailed characteristics of the 28 studies (31 trials) are presented in Table 1. A total of 2038 patients with breast cancer were included in these studies. The sample size included studies ranging from 16 to 242, and published between 2003 and 2016. The mean age of patients was between 26 and 78 years old.

Table 1. Characteristics of the included studies.

Author	Year	Sample size	Mean age (years)	Type of exercise	Outcome measures
Cadmus et.al	2009	IG-H: 25; CG-H: 25 IG-S: 37; CG-S: 37	IG-H: 54.5±8.2; CG-H: 54.0±10.9 IG-S: 56.5±9.5; CG-S: 55.1±7.7	NR	FACT-B
Chandwani et.al	2010	IG: 27; CG: 29	IG: 51.39±7.97; CG: 40.2±9.96	AE	SF-36

Chen et.al	2013	IG: 49; CG: 47	IG: 45.3±6.3; CG: 44.7±9.7	AE	FACT-G
Courneya et.al	2003	IG: 24; CG: 28	IG: 59±5; CG: 58±6	AE	FACT-B
Courneya et.al	2007	IG-1: 78; IG-2: 82; CG: 82	IG-1:30-75; IG-2:25-76; CG:26-78	IG-1: AE IG-2: RE	FACT-A
Cramer et.al	2015	IG: 19; CG: 21	IG:48.3±4.8; CG:50.0±6.7	AE	FACT-B
Culos-Reed et.al	2005	IG: 18; CG: 18	All: 51.18±10.33	AE	C-30
Danhauer et.al	2009	IG: 13; CG: 14	IG: 54.3±9.6; CG: 57.2±10.2	AE	FACT-B
De Luca et.al	2016	IG: 10; CG: 10	IG: 50.2±9.7; CG: 46.0±2.8	Combined AE + RE	FACT-G
Galiano-Castill et.al	2016	IG: 39; CG: 37	IG: 47.4±9.6; CG: 49.2 ±7.9	Combined AE + RE	C-30
Hagstrom et.al	2016	IG: 19; CG: 15	IG:51.2±8.5; CG:52.7±9.4	RE	FACT-G
Haines et.al	2010	IG: 33; CG: 32	IG: 55.9±10.5; CG: 54.2±11.5	Combined AE + RE	C-30
Herrero et.al	2006	IG: 8; CG: 8	IG: 50±5; CG: 51±10	Combined AE + RE	C-30
Hornsby et.al	2014	IG: 10; CG: 10	IG:51±6; CG:46±11	AE	FACT-B
Lahart et.al	2016	IG: 37; CG: 33	IG: 52.4±10.3; CG: 54.7 ±8.3	AE	FACT-B
Littman et.al	2012	IG: 27; CG: 27	IG: 60.6±7.1; CG: 58.2±8.8	AE	FACT-G
Milne et.al	2008	IG: 29; CG: 29	IG:55.2±8.4; CG:55.1±8.0	Combined AE + RE	FACT-B
Moadel et.al	2007	IG: 84; CG: 44	IG: 55.11±10.07; CG: 54.23±9.81	AE	FACT-G
Murtezani et.al	2014	IG: 30; CG: 32	IG: 53±11; CG: 51±11	AE	FACT-B
Mutrie et.al	2007	IG: 82; CG: 92	IG: 51.3±10.3; CG: 51.8±8.7	Combined AE + RE	FACT-G
Reis et.al	2013	IG: 12; CG: 17	IG: 54±11.1; CG: 59±10.7	AE	FACT-G
Rogers et.al	2009	IG: 20; CG: 19	IG:52±15; CG:54±8	AE	FACT-B
Sandel et.al	2005	IG: 19; CG: 19	IG: 59.7±9.8; CG: 59.5±13.3	AE	FACT-B
Schmidt et.al	2015	IG: 45; CG: 32	IG: 53±11; CG: 51±11	RE	C-30
Shobeiri et.al	2016	IG: 27; CG: 26	IG: 43.5±8.6; CG: 42.7±9.6	AE	C-30
Steindorf et.al	2014	IG: 76; CG: 32	IG: 55.2±9.5; CG: 56.4±8.7	RE	C-30
Swisher et.al	2015	IG: 18; CG: 10	IG: 43-65; CG: 36-71	AE	FACT-B
Thorsten et.al	2015	IG-1: 21; IG-2: 21; CG: 26	IG-1: 56±10.15; IG-2: 53±12.55; CG: 54 ±11.19	IG-1: AE IG-2: RE	C-30

Note: IG: exercise intervention group; CG: control group; IG-H: home-based exercise intervention group; IG-S: supervised exercise intervention group; IG-1: aerobic exercise intervention group; IG-2: resistance exercise intervention group; AE: aerobic exercise; RE: resistance exercise; Combine AE + RE: combined aerobic and resistance exercise; NR: not reported; FACT-G: Functional Assessment of Cancer Therapy-General; FACT-B: Functional Assessment of Cancer Therapy-Breast; FACT-A: Functional Assessment of Cancer Therapy-Anemia; C-30: European Organization for Research and Treatment of Cancer Quality of Life Questionnaire; SF-36: Health Survey Short Form-36.

3.3. Effect of Exercise Intervention on QOL for Breast Cancer Survivors

Data from 28 articles (31 trials) were pooled for analysis. The result of meta-analysis showed that the change in QoL was extremely favourable for the exercise intervention group with heterogeneity $Tau^2 = 0.18$; $Chi^2 = 114.13$; degrees of freedom (df) = 30; $I^2 = 74\%$, and the combined SMD (95% CI) was 0.44 (0.26–0.62). Due to the high heterogeneity, the random-effects model was used (Figure 2).

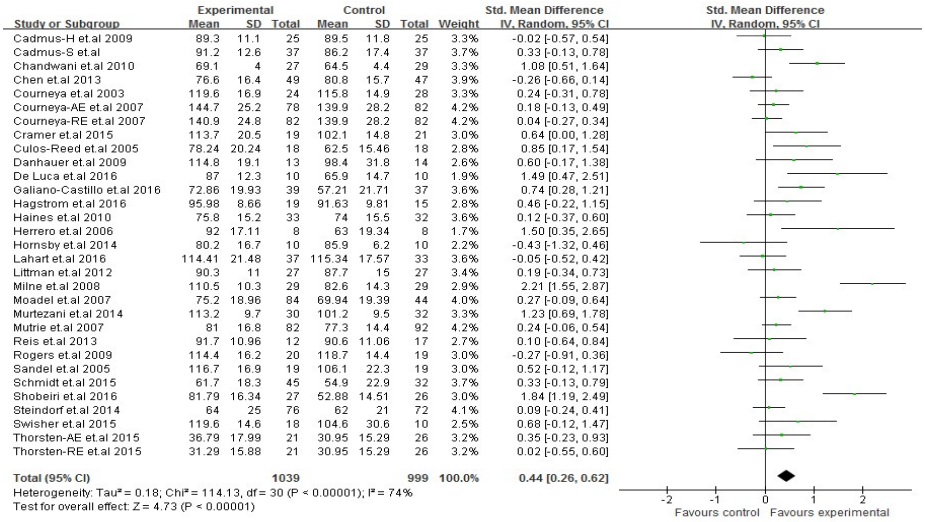

Figure 2. Meta-analyses of the impact of exercise on QoL.

3.4. Subgroup Analysis of Exercise Types

The subgroup analysis revealed that AE (SMD = 0.42; I^2 = 72%; 95% CI: 0.17–0.67, p = 0.0009) and CO (SMD = 0.97; I^2 = 87%; 95% CI: 0.33–1.61, p = 0.003) had a positive effect on QoL. However, as for RE, no significant difference was observed between the groups (SMD = 0.13; I^2 = 0%; 95% CI: -0.05–0.31, p = 0.17). The pooled SMD (95%) of CO (SMD = 0.97; 95% CI: 0.33–1.61) more than the pooled SMD (95%) of AE (SMD = 0.42; 95% CI: 0.17–0.67) (Figure 4).

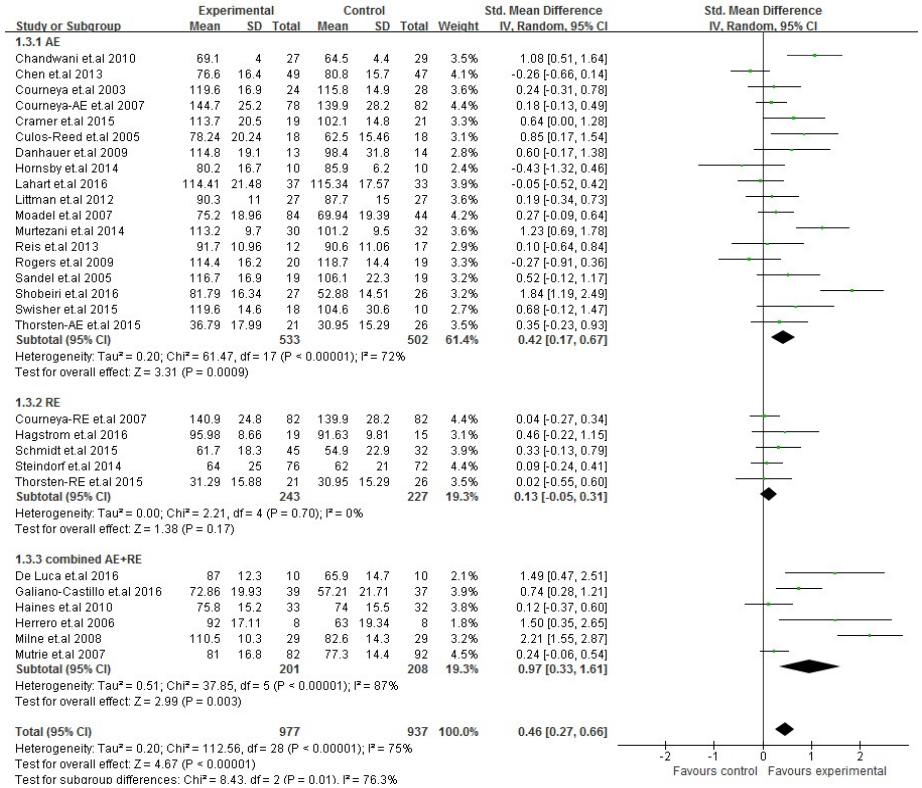

Figure 4. Subgroup analyses of exercise types.

4. Conclusions

In summary, our findings show that exercise intervention may increase self-reported QoL in breast cancer patients. The most appropriate type of exercise to improve QoL is probably CO.

Author Contributions: Conceptualization, W.Y., and Y.F.; methodology, W.Y., and F.H.; validation, W.Y., and Y.F.; formal analysis, F.H., and Y.F.; investigation, F.H., and W.Y.; resources, F.H., and W.Y.; data curation, F.H., and W.Y.; writing—original draft preparation, F.H. and W.Y.; writing—review and editing, Y.F.; visualization, F.H. and W.Y.; supervision, W.Y.; project administration, W.Y., and Y.F.; funding acquisition, W.Y.

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Conflicts of Interest: The authors declare no conflict of interest.

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