ORIGINAL ARTICLE

Effects of Exercise on Quality of Life in Women Living with Breast Cancer: A Systematic Review

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■ **Abstract:** The goal of this systematic review was to examine the effect of exercise on quality of life (QOL) in women living with breast cancer. Data bases searched were MEDLINE, EMBASE, CINAHL, PubMed, and PEDro. Keywords were "breast cancer and quality of life" in combination with "exercise" or "physical activity" (with associated Mesh terms). Limits were English or French language. Included studies were independently reviewed for methodological quality (van Tulder et al.) and assigned a level of evidence (Centre for Evidence-Based Medicine). Nine relevant randomized controlled trials were included: four of moderate methodological quality and five of high methodological quality. There was strong evidence that exercise positively influences QOL in women living with breast cancer. Exercise can be an effective strategy to improve QOL in women living with breast cancer. Future research is necessary to determine optimal exercise types and parameters. ■

Key Words: aerobic exercise, breast cancer, exercise, quality of life, resistance exercise

One in eight US women will develop breast cancer in 2006 and one third will succumb to the disease. With improved screening and adjuvant therapy, mortality has declined at a rate of 2.7% per year since 1993 (1). Physical exercise improves overall health and enhances mood and quality of life (QOL) (2,3), defined as overall pleasure, comfort and enjoyment in one's life. Improved QOL as a result of exercise can be noted in as little as 6 weeks (2). A recent meta-analysis examined the effects of leisure time exercise on QOL, as well as on cardiorespiratory fitness/physical functioning, fatigue, and body composition (4). Although there are similarities between that study and our systematic review, we focused on structured exercise programs, lasting a minimum of 4 weeks, and their impact on QOL in women with all stages of breast cancer. Since that 2006 meta-analysis (4), two additional studies have been published and are included in this review (5,6). The purpose of our systematic review was to examine the effect of exercise on QOL in women living with breast cancer at all stages of the disease.

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METHODS

Literature Search

MEDLINE, EMBASE, CINAHL, PubMed, and PEDro data bases were searched using keywords "breast cancer" and "quality of life" or "QOL" in combination with "exercise" or "physical activity" (with associated Mesh terms), limited to articles in English or French. Reference lists of included articles were scanned for additional relevant studies. Throughout the analysis and writing, these data bases were continually monitored for new articles.

Inclusion and Exclusion Criteria

The first five authors conducted the initial screening of retrieved articles. Titles and abstracts were independently assessed twice to determine relevance to the topic of this review. Remaining articles proceeded to full review. Inclusion criteria were (i) population (females diagnosed with breast cancer), (ii)

intervention (physical activity or exercise), (iii) outcome (QOL), (iv) outcome measure (standardized QOL measurement tool), (v) study design (randomized controlled trial [RCT]), and (vi) publication (published in a peer-reviewed journal).

Articles were excluded if (i) they were review articles; descriptive, correlational, observational or survey studies; unpublished dissertations; or abstracts only, (ii) the form of physical activity or exercise was related to a person's occupation, (iii) the physical activity or exercise intervention was carried out for <4 weeks, and (iv) the study did not use a standardized QOL outcome measure.

Quality Assessment

Studies that met the inclusion criteria were rated for methodological quality by two authors using the van Tulder et al. (7) criteria (Table 1), with indicators ranked as yes, no, or unknown. A third reviewer determined consensus if there was disagreement. Indicators D and E received a "no" score for all studies due to inability to blind the patient and care providers to exercise versus control. For indicator H, compliance was set at a minimum of 65%. If the article did not provide enough information to answer a particular quality indicator, the respective author(s) was contacted for further information.

Studies reviewed using the van Tulder et al. (7) quality assessment criteria were further assessed using the Oxford Centre for Evidence-Based Medicine (CEBM) Levels of Evidence (8) for quantitative analysis of strength of evidence. CEBM's five levels were used to rank the validity of evidence in each study, then translated into grades of recommendations based on this ranking (Table 2). Because all included studies met the criterion of adequate randomization, only levels 1 and 2 were required for analysis. Again, each study was assessed independently by two reviewers with a third reviewer available to determine consensus, if disagreement arose.

Table 1. van Tulder et al. (7) Criteria for Methodological Quality Assessment

A	Was the method of randomization adequate?
B	Was the treatment allocation concealed?
C	Were the groups similar at baseline regarding the most important prognostic indicators?
D	Was the patient blinded to the interventions?
E	Was the care provider blinded to the intervention?
F	Was the outcome assessor blinded to the intervention?
G	Were cointerventions avoided or similar?
H	Was the compliance acceptable in all groups?
I	Was the drop-out rate described and acceptable?
J	Was the timing of the outcome assessment in all groups similar?
K	Did the analysis include an intention-to-treat analysis?

RESULTS

Three authors examined the included studies and extracted data based on predetermined categories. See Table 2 for a detailed summary of each study.

Inter-Rater Agreement

The three authors agreed on 94/99 possible choices using the van Tulder et al. (7) assessment. Point-by-point agreement varied across studies from 81% (9) to 100% (5,10–13). Each study was scored by two of the three raters. Discrepancies were resolved through discussion, a third party, or by contacting the authors for additional information so that a final total score for each paper could be obtained (Table 3). There was 100% agreement when assigning the CEBM (8) rankings of levels of evidence to the studies (Table 4).

Methodological Quality

The van Tulder et al. (7) criteria were used to rate methodological quality of the included studies. We categorized scores of 0–3 as poor quality, 4–6 as moderate and ≥7 as high quality. Four studies were of moderate quality (9,11,14,15) and five of high quality (5,6,12,13,16).

Exercise Intervention

All studies involved an exercise intervention group versus a control group, except for Segal et al. (13) who separated the exercise group into supervised and nonsupervised. Of the nine studies included, two observed the effects of an aerobic exercise program (10,13), one studied the effects of a resistance-training program (6) and three examined the effect of combined aerobic and resistance-training (5,9,14). Authors of the remaining three studies did not categorize the intervention as either aerobic or resistance (11,12,15). Headley et al. (15) studied the effects of a seated gentle active range of motion program, Sandel et al. (12) examined the effect of dance and movement therapy, while Mustian et al. (11) looked at the effects of a slow repetitive movement program (Tai Chi Chuan). Specific details for each exercise intervention are in Table 5.

Table 2. Summary Table of Included Studies

Authors/Year	Subjects	QOL outcome measure	Follow-up	Results	Level of evidence (CEBM)	Additional comments
Segal et al. 2001	*n* = 99 Average age = 51 years Stages I and II 67% undergoing adjuvant CT All recruited within 2 weeks of the initiation of adjuvant therapy (RT, HR, CT)	SF-36 FACT-G FACT-B	Baseline, 26 weeks	SF-36: Significant improvement (p = 0.01) in the physical functioning subscale for the self-directed group and a positive trend (p = 0.09) for the supervised exercise group No significant changes in all other subscales FACT-G: No significant differences among groups (p = 0.29) FACT-B: No significant differences among groups (p = 0.17)	Level 2	Data obtained for 80.4% of participants 71.5% completion of exercise sessions in both supervised and self-directed groups
Courneya et al. 2003	*n* = 52 Average age: 59 years 100% post RT, CT and/or surgery 100% postmenopausal Stage: I = 40%; IIa = 33%; IIb = 21%; IIIa = 6%	FACT-G FACT-B	Baseline, postintervention	FACT-G: Changes favored the exercise group, but were not significant (p = 0.016) FACT-B: Significant change between groups (p = 0.001)	Level 2	Exercise group adherence: 98.4% Nonprotocol related exercise: not different between groups (p = 0.890)
McKenzie et al. 2003	*n* = 14 Average age: 57 years 100% unilateral upper extremity lymphedema Stage I or II >6 months post-treatment	SF-36	Baseline, 8 weeks	SF-36: No significant changes. Positive trends seen in various domains: Physical functioning (p = 0.050) General health (p = 0.048) Vitality (p = 0.023) Mental health (p = 0.019)	Level 2	Nine of 14 participants were overweight or obese according to the body mass index
Headley et al. 2004	*n* = 38 Average age: 51 years Stage IV All scheduled to initiate out-patient CT	FACIT-F	Baseline and four times over 12 weeks (at the start of each round of CT)	FACIT-F: Total well-being of the exercise group decreased at a significantly slower rate than the control group (p = 0.0254)	Level 2	Exercise group significantly more likely to be married. Some subjects stated that the intervention was not physically challenging 75% exercise attendance for exercise group
Mustian et al. 2004	*n* = 21 Average age: 52 years Stages: 0–IIIb 100% postsurgery (1 week–30 months) Many undergoing adjuvant therapy: 84% CT 61% RT 56% HT	FACIT-F	Baseline, 6, 12 weeks and daily logs	FACIT-F: Exercise group had significant improvements in health related QOL (p = 0.03) Control group had no significant improvements in health related QOL (p = 0.14)	Level 1	72% exercise attendance for exercise group

Table 2. Continued

Authors/Year	Subjects	QOL outcome measure	Follow-up	Results	Level of evidence (CEBM)	Additional comments
Campbell et al. 2005	*n* = 19 Average age: 47.5 years Early stages 100% postsurgery Current CT and/or RT	FACT-G FACT-B SWLS	Baseline, 12 weeks	FACT-B: No significant differences between groups with a positive trend for the exercise group (p = 0.094) FACT-G: Significant changes between groups (p = 0.046) SWLS: No significant changes between groups (p = 0.315) FACT–B and SWLS: Results favored the intervention group, although not significant	Level 2	Average of 70% of sessions completed by all participants
Sandel et al. 2005	*n* = 35 Average age: 61 years 100% postsurgery: Mean of 331 days for the exercise group Mean of 336 days for the wait-list group Self-reported lymphedema in three participants	FACT-B SF-36	Baseline, 13, 26 weeks	FACT-B: Significant improvement in intervention group at 13 weeks (p = 0.008) Significant improvement in overall sample at 26 weeks (p = 0.003) SF–36: Body Image subscale improved significantly in both groups at 13 and 26 weeks (p = 0.001) Physical subscale improved significantly for both groups (p = 0.012) at 13 but not at 26 weeks (p = 0.06) Mental Health subscale did not improve (p = 0.38) for both groups at 13 weeks, but improved significantly at 26 weeks (0.006)	Level 1	Some participants were undergoing adjuvant CT or RT
Ohira et al. 2006	*n* = 79 Average age: 53 years Stage: 0 = 15%; I = 40%; II = 39%; III = 5%	CARES-SF	0, 6 months	CARES-SF global score: No significant change (p = 0.08) between groups Significant changes in the physical (p = 0.006) and psychosocial (p = 0.02) subscales	Level 1	
Herrero et al. 2006	*n* = 16 Average age: 50.5 years Stages I and II Postmenopausal 2-5 years post-treatment (surgery, CT and/or RT)	EORTC-QLQ-C30	Baseline, 8 weeks	EORTC QLQ-C30: Training group had a significant mean change in both the global (p = 0.002) and physical function scales (p = 0.04)	Level 1	91.1% average adherence to training for the exercise group

CARES-SF, Cancer Rehabilitation Evaluation System Short Form; CEBM, Centre for Evidence-based Medicine; CT, chemotherapy; EORTC-QLQ-C30, European Organization for Research and Treatment of Cancer Questionnaire; FACIT-F, Functional Assessment of Chronic Illness Therapy-Fatigue version IV; FACT-B, Functional Assessment of Cancer Therapy-Breast; FACT-G, Functional Assessment of Cancer Therapy-General; HR, hormone replacement therapy; *n*, number of participants; QOL, quality of life; RT, radiation therapy; SF-36, Medical Outcomes Trust 36-Item Short Form Survey; SWLS, Satisfaction with Life Scale.

Table 3. van Tulder et al. (7) Quality Assessment Results

	Segal et al. 2001	McKenzie & Kalda 2003	Courneya et al. 2003	Mustian et al. 2004	Headley et al. 2004	Campbell et al. 2005	Sandel et al. 2005	Ohira et al. 2006	Herrero et al. 2006
A	Y	Y	Y	Y	Y	Y	Y	Y	Y
B	Y	N	Y	N	Y	U	Y	Y	Y
C	Y	Y	Y	Y	Y	Y	Y	Y	Y
D	N	N	N	N	N	N	N	N	N
E	N	N	U	N	N	U	N	N	N
F	N	N	Y	N	N	N	N	U	Y
G	Y	U	Y	Y	Y	Y	U	Y	Y
H	Y	Y	Y	Y	Y	Y	Y	Y	Y
I	N	Y	Y	Y	Y	Y	Y	Y	Y
J	Y	Y	Y	Y	N	Y	Y	Y	Y
K	Y	N	N	N	N	N	Y	N	N
Total	7	5	8	6	6	6	7	7	8

Y, Yes; N, No; U, Unknown.

Table 4. Rankings and Grades: Oxford Centre for Evidence-based Medicine (8)

First author and year	Level	Grade
Segal 2001	2(b)	B
McKenzie 2003	2(b)	B
Courneya 2003	2(b)	B
Mustian 2004	1(b)	A
Headley 2004	2(b)	B
Campbell 2005	2(b)	B
Sandel 2005	1(b)	A
Ohira 2006	1(b)	A
Herrero 2006	1(b)	A

Quality of Life

For our review, only validated outcome measures specific to QOL were included (Table 2). Seven different QOL tools were used within the nine studies. The Functional Assessment of Cancer Therapy-Breast (FACT-B), a specific QOL tool for patients with breast cancer (14), was the most widely used. Four studies used the FACT-B (10,12–14), with three of these also using the FACT-general (10,13,14), a QOL measure for all types of cancer. Campbell et al. (14) used a third QOL outcome measure, the Satisfaction with Life Scale. The Functional Assessment of Chronic Illness Therapy-Fatigue version IV developed for use in cancer clinical trials, was another QOL tool used in two studies (11,15). Three studies used a more general QOL tool, the Medical Outcomes Trust 36-Item Short Form Survey or SF-36 (9,12,13). Ohira et al. (6) assessed QOL using the Cancer Rehabilitation Evaluation System Short Form. The European Organization for Research and Treatment of Cancer Questionnaire was used by Herrero et al. (5).

DISCUSSION

Exercise improves mood and QOL by increasing overall health through socialization, goal setting, participation, decreased body weight, or decreased fatigue (2,3). As many issues contribute to decreased QOL, our review examined solely exercise interventions to improve overall QOL in women with breast cancer.

Three prior reviews have examined the effect of exercise on QOL in cancer survivors (17–19). McNeely et al. (4) examined the effect of exercise primarily on QOL, physical functioning or cardiorespiratory fitness and secondarily on fatigue and body composition in women with breast cancer, whereas our review focused solely on QOL. We included only RCTs involving structured exercise programs lasting a minimum of 4 weeks and using a standardized QOL measurement tool. Because of our increased focus, eight studies included in the meta-analysis (4) were excluded from our review, but two studies (12,15) not included in the earlier review were added. McNeely et al. (4) included only participants with stage 0–III breast cancer, whereas our review also included stage IV. Since the publication of the meta-analysis, two additional studies have been published and are included in this review (5,6).

Demographic Characteristics

Demographic characteristics differed among the nine studies in our review. Eight studies (5,6,9,10,12–15) examined age as a baseline demographic characteristic, with mean ages from 51 years (15) to 61 years (12). Consistently included were weight, height, race, education, marital status, disease stage, treatment type, and initial activity level. For the majority of these characteristics, the control and intervention

Table 5. Exercise Interventions

Author/ Year	Intervention	Length	Frequency	Duration	Supervision
Segal 2001	Self-directed or supervised walking programs	n/s	5x/week	26 week	Yes (3x/ week)
McKenzie 2003	Resistance training + aerobic exercise added after 2 week on bicycle	~60–70 minutes	3x/week	8 week	Yes
Courneya 2003	Recumbent or upright cycle ergometers	25–45 minutes	3x/week	15 week	Yes
Mustian 2004	Tai chi chuan versus psychosocial group	60 minutes	3x/week	12 week	Yes
Headley 2004	Active seated stretching exercises of UE and LE	30 minutes	3x/week	12 week	No
Campbell 2005	Varied aerobic and resistance exercise	10–20 minutes + warm-up and cool-down	2x/week	12 week	Yes
Sandel 2005	Dance and movement program	~60 minutes	2x/week = first 6 week; 1x/week = last 6 week	12 week	Yes
Ohira 2006	Resistance training	~60 minutes	2x/week	6 month	Yes (first 3 months only)
Herrero 2006	Aerobic & resistance training	90 minutes	3x/week	8 week	Yes

LE, lower extremities; n/s, not specified; UE, upper extremities.

groups in the studies did not differ. However, Headley et al. (15) found that control group participants had a higher level of education and were more likely to be unmarried than the intervention group. Mustian et al. (11) also found baseline QOL differences between control and intervention groups, i.e., the intervention group had higher self-esteem, a possible confounding variable to explain the significant improvement in QOL within the intervention group.

Limitations

Limitations became apparent when comparing results of the nine studies included in this review. Although each study implemented an exercise intervention as the independent variable, types, and intensities of exercise protocols varied. Interventions ranged from gentle chair exercises (15), dance and movement therapy (12) and Tai Chi Chuan (11), to more rigorous activities such as walking (13,14), aerobic training (5,9,10,14), and resistance exercises (5,6,9,14). Because each study examined a different form of exercise, it is difficult to determine what frequency, intensity, type, and time may be most effective and safe in improving QOL for this population. Another limitation was the heterogeneity of the QOL measures used. Although all are standardized and valid, they contain different domains and assessment criteria, thus affecting our ability to directly compare each QOL outcome measure to determine a cumulative end result.

We caution generalizing the cumulative results of these studies for several reasons. The majority of women who participated were Caucasian and thus not representative of the breast cancer population as a whole. McKenzie et al. (9) included only women with unilateral upper extremity lymphedema. Though a significant increase in QOL in the intervention group was reported, these results cannot be generalized to the entire breast cancer population.

Researchers who conducted the different studies included women with different stages of breast cancer; eight included women at stages 0–III (5,6,9–14), whereas one (15) included only women with advanced breast cancer (stage IV). Although that study was alone in inclusion of stage IV participants, it is important because of limited evidence for exercise involving women with this stage. Although both control and intervention groups showed decreases in QOL scores, these results were expected with advanced breast cancer. However, there was a lesser decrease in QOL in the intervention group. Further limitations in the included studies were the inability to blind participants from their assigned group and the small sample sizes.

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