PSYCHOLOGICAL AND FITNESS CHANGES ASSOCIATED WITH EXERCISE PARTICIPATION AMONG WOMEN WITH BREAST CANCER

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SUMMARY

Exercise participation has been shown to improve cardiovascular fitness and reduce psychological distress among women receiving chemotherapy and/or radiation. The purpose of this pilot study was to examine the changes in distress and body image, and fitness following exercise participation among 24 women who had been diagnosed with breast cancer within the previous 3 years. The women were randomly assigned to participate in a 12-week supervised aerobic exercise program in a hospital setting or a wait-list control group. Assessments of distress and body image were conducted at pre- and post-treatment. Data showed that the women in the exercise group improved significantly in body image (Physical Condition and Weight Concerns subscales) vs control group participants at post-treatment. Reductions in distress were also noted in the exercise group, but these were nonsignificant. At post-treatment, there were modest improvements in fitness in the exercise group. Copyright © 2002 John Wiley & Sons, Ltd.

INTRODUCTION

Previous research has indicated that cancer patients frequently experience considerable psychological distress as a result of being diagnosed with and treated for cancer (Vinokur et al., 1989; Watson et al., 1991). The Psychological Aspects of Breast Cancer Study Group (1987) found that State I–II breast cancer patients had statistically significant levels of somatic distress, depression of self, poor body image, psychosocial impairment and physical complaints such as fatigue, weight gain and sleep disturbances. These difficulties appear to be long-lasting, as longitudinal studies have found persistent levels of psychological distress among patients a year following diagnosis (Vinokur et al., 1990) despite improvements in physical functioning.

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The rationale for considering exercise as an intervention to reduce distress in cancer patients is based primarily upon the substantive literature that has demonstrated the psychological benefits of exercise in nononcology populations (King et al., 1991; Ossip-Klein et al., 1989; USDHHS, 1996). The role of exercise in breast cancer has been examined in only a few retrospective (Courneya and Freidenreich, 1997; Young-McCaughan and Sexton, 1991), cross-sectional (e.g. Pinto et al., 1998) and prospective studies (MacVicar et al., 1989; Mock et al., 1997; Segar et al., 1998) (see reviews by Courneya and Freidenreich, 1999; Pinto et al., 2000; Pinto and Maruyama, 1999).

Among the prospective studies, improvements in work capacity (peak oxygen uptake) have been demonstrated among early-stage breast cancer patients (on chemotherapy) following participation in a 10-week cycle ergometry protocol (MacVicar and Winningham, 1986; MacVicar et al., 1989). Patients who exercised also reported reductions in tension, confusion and nausea (MacVicar and Winningham, 1986). Similarly, breast cancer patients receiving chemotherapy...
reported improvements in anxiety, depression, fatigue and nausea following participation in a 6-month structured program of walking and attendance at support groups (Mock et al., 1994). However, the above study design did not allow for an evaluation of the benefits of exercise alone. Breast cancer patients receiving radiation treatment have also reported significant improvements in physical functioning, anxiety, fatigue and sleep following a 7-week walking program vs control group participants (Mock et al., 1997). These results demonstrated that breast cancer patients can participate in exercise programs during cancer treatments, and such participation can help attenuate treatment-related symptoms, difficulties and distress.

Besides the potential reduction in distress associated with exercise adoption, there may be other benefits that exercise can offer for women with breast cancer. Investigators have reported persisting effects of cancer treatment on the body image of women with breast cancer (Schain et al., 1994; Schover et al., 1995). In healthy groups, exercise adoption is associated with improvements in body image (Adame et al., 1990). Thus, one can propose that the adoption of a healthy behavior, such as exercise, may give survivors an increased sense of self as healthy, while the improvements in bodily strength and tone, along with potential weight loss, might bring about beneficial changes in body image. There is preliminary evidence that exercise may have a protective effect against the deterioration of body image in women with breast cancer (Mock et al., 1994). Hence, we were interested in exploring the effects of exercise adoption on body image in a breast cancer population.

At present, there is limited information on guidelines for physical activity in cancer patients. Further, the information that is available is relevant to patients receiving chemotherapy (Winningham, 1991) or following bone marrow transplantation (Dimeo et al., 1997b). It has been recommended that prior to advising patients to exercise, clinicians should assess patients for cardiopulmonary deficits (e.g. chemotherapy-related cardiovascular changes, hypertension, pneumonitis), musculoskeletal problems (e.g. bone pain or metastases), sensory limitations (e.g. chemotherapy-induced neuropathies (Smith, 1996) and hematological function, particularly among those who have recently undergone chemotherapy (Dimeo et al., 1997a). To avoid some of these potential problems, we selected participants with early stage disease, who had completed active cancer treatment (excluding hormone treatment such as Tamoxifen) at least a month prior to entry into the study.

In sum, prior research suggests that patients who have been treated for cancer can safely exercise, and there is preliminary evidence supporting cardiovascular benefits and mood improvement particularly among breast cancer patients participating in exercise programs. Therefore, in this study we used a randomized, controlled group design to evaluate the effects of exercise on distress and body image among women with Stage 0–II breast cancer. Our primary question in this pilot study was: Does exercise participation alter affective distress and body image disruption among sedentary women who have had breast cancer vs those who remain sedentary? We hypothesized that, at post-treatment, there would be greater reduction in psychological distress (as assessed by the Total Mood Disturbance scale of the Profile of Mood States) and body image concerns in the exercise group (EG) vs the control group (CG). We selected sedentary women to demonstrate effects of an intervention program rather than women who were already exercising and therefore are less likely to show benefits from participating in an exercise program (i.e. potential ceiling effects). A secondary goal was to demonstrate improvement in fitness among those participating in the exercise program. This was a secondary goal because improvement in fitness per se is not always necessary for mood benefits (e.g. review by Byrne and Byrne, 1993).

**METHOD**

**Subjects and design**

This was a randomized controlled trial, approved by our Institutional Review Committee, comparing two conditions: (a) moderate (60–70% maximum heart rate) on-site aerobic exercise training and (b) wait-list control group. Exercise training was provided over 12 weeks. Twenty-four sedentary women with Stage 0–II breast cancer (post-surgery) were randomized to either the EG or the CG. Due to difficulties in recruiting participants over the year of grant funding, we had to halt recruitment when 24 subjects were
randomized, although power analysis indicated that a sample size of 30 (15 in each group) was needed to detect significant differences on the Total Mood Disturbance score on the Profile of Mood States (effect size as noted by MacVicar and Winningham, 1986) (power = 0.80, 2 tailed alpha = 0.05; Cohen, 1988).

Procedure

We recruited sedentary women (exercised <3 times per week for 20 min per session) who had been diagnosed with breast cancer (Stages 0, I or II) over the past 3 years. Post-surgery patients who had completed chemotherapy or radiation treatment were invited to participate in a 12-week exercise program or a wait-list CG. Recruitment channels included community sources, newspaper advertisements, flyers and physician referrals. Exclusion criteria included: medical or current psychiatric illness which would make compliance with the study protocol difficult or dangerous (e.g. coronary artery disease, hypertension, diabetes), orthopedic problems or neuropathies which would limit exercise training. Medications which would alter training responses (e.g. beta-blockers) or affect distress outcomes (e.g. anti-depressants) were also reasons for exclusion. Subjects were asked to obtain permission from their physicians prior to participation. Subjects also agreed to be assigned randomly to either of the two investigational conditions and signed a consent form.

Subjects were asked to complete a peak graded exercise stress test (ETT) following American College of Sports Medicine (ACSM) guidelines (ACSM, 1995). Following a 2 min warm-up period, subjects began the ETT by pedaling at a rate of 50 rpm on a calibrated cycle ergometer with an increase in workload of 25 W every 2 min. The ETTs were terminated according to ACSM guidelines (1995). Heart rate, blood pressure, ECG and rate of perceived exertion were monitored throughout the ETT by an exercise physiologist with a cardiologist on call. Pre- and post-ETTs were reviewed by a cardiologist. Peak workload, exercise time, blood pressure, heart rate and rate pressure product were used to evaluate exercise response. In the absence of medical contraindications for exercise, subjects were randomly assigned to the EG or CG.

Of the 151 women screened for eligibility, 24 were found to be eligible and were randomized. Reasons for ineligibility included: inability to contact by telephone after at least three attempts (25%), lack of interest (19%), medical conditions (e.g. hypertension) (18%), transportation and/or scheduling difficulties (11%), other reasons such as lack of a breast cancer diagnosis, deceased, State III-IV breast cancer (11%), cancer recurrence (6%) and too physically active (5%). Of the randomized sample of 24 women (mean age = 52.5 years, S.D. = 6.8), 80% (n = 19) were married, and a majority had completed high school or greater (30% high school diploma, 30% college degree). Forty-two percent reported an annual income of $60,000 and 67% (n = 16) were working full-time. Mean weight was 150.0 lbs. (S.D. = 28.2), and mean Body Mass Index (BMI) was 26.8 (S.D. = 4.1). Seventy-one percent (n = 17) reporting being post-menopausal at baseline. A majority had been diagnosed with Stage I disease (n = 18, 78%; Stage II, n = 3, 13%; Stage 0, n = 2, 9%). Mean days since diagnosis was 452.6 (S.D. = 234.9) and mean days since completion of medical treatment was 323.5 (S.D. = 212.3). A majority of the sample had surgery (n = 23, 96%; 43% had lumpectomy plus axillary dissection, and 35% had mastectomies), radiation (n = 15, 65%) and hormone treatment (n = 14, 61%). Only 30% (n = 7) had chemotherapy.

Exercise group (EG)

Following the baseline ETT, subjects randomized to the supervised exercise intervention were taught basic exercise principles and techniques (e.g. stretching techniques, warm-up/cool down). Aerobic exercise sessions were conducted three times per week for 12 weeks with make-up sessions. Initial exercise prescriptions including mode, intensity and duration were based on the ETT. Each subject began the exercise program at an individually appropriate exercise intensity and achieved cardiovascular training at 60–70% of peak heart rate by the end of the 12-week intervention. Over the 12 weeks, the exercise session developed into 10 min of warm-up (cardiovascular and flexibility), 10 min of cool down (cardiovascular and flexibility) and 30 min of cardiovascular activity in one’s target heart rate zone. The cardiovascular activities included treadmill walking, arm and leg ergometers, arm cycling, stationary cycling and rowing. To tailor...
the program for women who have had breast surgery and improve upper body endurance, we encouraged arm cycling and rowing during the sessions. Subjects used at least three modes of physical activity per session that would ensure at least one cardiovascular arm activity. We individualized participants’ arm exercise regimens to accommodate limitations due to surgery.

Participants took their heart rate at the beginning of every exercise session and during every activity. An exercise physiologist monitored participants’ blood pressure and heart rate once a week at pre-, during and post-exercise. Individual exercise prescriptions were updated before each session. During the last month of the exercise intervention, we introduced strength training with light weights (1–5 lbs. hand-held weights) for the triceps, biceps, pectoral muscles, shoulders and upper back, and stomach crunches: these muscle endurance exercises were offered to improve upper body endurance. Also, subjects were given instructions for exercising at home. They were encouraged to start exercising on their own at least once a week.

Control group (CG)

Participants assigned to this group (n = 12) were asked to complete assessments following the same schedule as EG subjects. These subjects were asked not to change their current level of physical activity. On completion of assessments, participants were offered the exercise program free of charge.

Measures

Peak exercise stress tests (described previously) were conducted at pre- (both groups) and post-treatment (EG only). Subject’s height and weight were recorded at pre- and post-treatment. Medical charts were reviewed to extract disease and treatment variables. One subject did not consent to the release of medical records for this purpose. A one-time payment of $30 was provided to subjects who provided data at the assessments. Participants were administered standardized measures to assess distress and body image at pre- and post-treatment. Before stress tests were conducted, participants completed the following questionnaires:

1. Profile of Mood States (POMS) (McNair et al., 1971). This 65-item measure taps six mood states including anger, tension, depression, vigor, fatigue, and confusion over the past week, and a summary score (total mood disturbance). Subscales and examples of stimulus items (in parentheses) are as follows: anger (angry, peevied), tension (tense, shaky), depression (unhappy, blue), vigor (lively, energetic), confusion (confused, muddled). Response options are presented on a scale of 0–4 (0=not at all, 4=extremely). The total mood disturbance scale is the sum of the scores across all six subscales with vigor scores weighted negatively. Reliability estimates range from 0.65 to 0.74. The POMS has been extensively used in research studies.

2. Positive and Negative Affect Scale (PANAS) (Watson et al., 1988). This was used to assess the subject’s positive and negative affect. Each of the 20 items on the PANAS required a response to ‘how you are feeling at the moment?’ on a 1–5 Likert scale (1 = Very slightly, 5 = Extremely). The two subscales have alpha reliabilities (0.86–0.87) and test re-test reliability is 0.54 for the Positive Affect scale and 0.45 for the Negative Affect scale (Watson et al., 1988).

3. Body Esteem Scale (Franzoi and Shields, 1984), is a 35-item scale assessing a subject’s evaluation of sexual attractiveness, physical condition and weight concerns. Individuals are asked to indicate ‘how you feel about this part or function of your own body’ using a 5 point Likert scale (1 = have strong negative feelings, 5 = have strong positive feelings). The sexual attractiveness scale includes items such as body scent, nose, lips, and sex drive; the physical condition subscale includes items such as physical stamina, reflexes, muscular strength, and energy level, and the weight concerns subscale includes items such as appetite, waist, thigh, body build, and weight. Internal consistency ranges from 0.78 to 0.87. Higher scores indicate more positive attitudes.

Post-treatment exercise stress tests (EG only) were conducted within 1 week of completion of the 12-week exercise program.

Analyses

We used t-tests and chi-square analyses to examine group differences at baseline: there was a statistically significant difference between groups.
for body esteem (Weight Concerns and Physical Condition subscales). Treatment effects were assessed by \( t \)-tests on change scores on the outcome variables. We used analyses of covariance to test for group differences in post-treatment scores on Weight Concerns and Physical Condition with baseline values as covariates.

**Results**

There were no significant group differences at baseline on demographic variables, disease variables, treatment variables and time since diagnosis of cancer. There were no significant group differences on pre-treatment ETTs performance and weight.

**Treatment adherence**

Of the 12 participants in the EG, three women discontinued participation within the first four weeks of the 12-week program (reasons included child-care responsibilities and inconvenience of traveling to the hospital). These individuals provided questionnaire data at post-assessments but did not complete post-treatment ETTs. The remaining subjects attended a mean of 88% of the 36-session exercise program and completed the ETT and questionnaire assessments at post-treatment.

**Fitness changes**

As seen in Table 1, the EG showed a significant decrease at post-treatment in baseline systolic and diastolic blood pressure (paired samples \( t = 3.0, df=8, p<0.05 \); \( t = 3.2, df=8, p<0.05 \)), and in peak systolic blood pressure (\( t = 2.8, df=8, p<0.05 \)). Significant reductions were also noted in the systolic and diastolic blood pressure (\( t = 3.5, df=8, p<0.01 \); \( t = 2.7, df=8, p<0.05 \)), and heart rate at 75 W (\( t = 2.7, df=8, p<0.05 \)). These data show modest evidence of fitness improvements in the EG.

**Psychological distress**

As seen in Table 2, mean scores on the Anger, Depression, Confusion, Tension, Fatigue and Total Mood Disturbance scales decreased, and Vitality scores increase from pre- to post-treatment in the EG. CG participants reported reductions in Vitality, Anger and Tension, and increases in Depression, Fatigue and Total Mood disturbances scores over 12 weeks. Similar changes were reported on the PANAS subscales. None of these changes were statistically significant. These analyses were repeated after excluding the three exercise participants who dropped out of the exercise program within the first four weeks. The results were unchanged.

<table>
<thead>
<tr>
<th>Table 1. Mean physiological variables during peak stress test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physiological measure</strong></td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Baseline systolic BP</td>
</tr>
<tr>
<td>Baseline diastolic BP</td>
</tr>
<tr>
<td>Baseline heart rate</td>
</tr>
<tr>
<td>Peak systolic BP</td>
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<tr>
<td>Peak diastolic BP</td>
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<tr>
<td>Peak heart rate</td>
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<tr>
<td>Peak watts</td>
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<tr>
<td>Systolic BP at 75 W</td>
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<tr>
<td>Diastolic BP at 75 W</td>
</tr>
<tr>
<td>Heart rate at 75 W</td>
</tr>
<tr>
<td>Rate of perceived exertion at 75 W</td>
</tr>
</tbody>
</table>

*Note: Paired samples \( t \) tests for exercise group only.*

\(*p \leq 0.05.*

\(**p \leq 0.01.*

Numbers in parenthesis are standard deviations.
Changes in the Physical Condition and Weight Concern subscales of the Body Esteem scale among the EG were significantly higher than in the CG ($F = 6.03$, df = 1, $p = 0.03$; $F = 5.77$, df = 1, $p = 0.03$) (Table 2). The EG showed significant improvements on these two subscale. There were no significant group differences on the Sexual Attractiveness subscale. As with the POMS data, we excluded the three EG participants who dropped out early in the program and repeated the analyses: group differences on the Physical condition and Weight Concerns subscales remained statistically significant. There were no significant changes in weight from pre- to post-treatment in the EG group (Pre-treatment mean weight = 152.7 lbs., S.D. 26.8; Post-treatment mean weight = 146.5 lbs., S.D. = 23.3).

**DISCUSSION**

Results of this pilot study indicate that the exercise intervention improved participants’ body image as seen in the EG’s significant improvement on two subscales of the Body Esteem Scale (Franzoi and Shields, 1984): Physical Condition and Weight Concern. In contrast, CG participants reported a reduction on these subscales. These findings replicate previous research which has found that exercise can prevent a decline in body image satisfaction in cancer patients participating in exercise during treatment (Mock et al., 1994), and that exercise can enhance body image in other populations (Adame et al., 1990). The Physical condition subscale assesses the individual’s evaluation of her stamina, strength and agility. These improvements are consistent with previous research which has shown improvements in VO2 in breast cancer patients receiving treatment, after their participation in a 10-week exercise program (MacVicar and Winningham, 1986; MacVicar et al., 1989). The Weight Concern subscale focuses on body parts such as the waist and thighs that can be altered through exercise or diet. The improvements on this subscale among the exercise participants are consistent with studies among noncancer samples that have shown improvements in body image following participation in diet and exercise programs (Cash, 1994; Werlinger et al., 1997). Interestingly, in contrast to data reported by Winningham et al. (1989), there were no significant changes in weight in the EG over time. The absence of effects of exercise on the sexual attractiveness subscale are not surprising, given that exercise does not affect lips, hair and other

**Table 2. Mean POMS, PANAS and BES scores for each group**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Exercise group Pre-treatment ($n = 12$)</th>
<th>Exercise group Post-treatment ($n = 12$)</th>
<th>Control group Pre-treatment ($n = 12$)</th>
<th>Control group Post-treatment ($n = 6$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>POMS anger</td>
<td>4.58 (3.6)</td>
<td>3.33 (4.1)</td>
<td>5.42 (5.3)</td>
<td>4.83 (3.6)</td>
</tr>
<tr>
<td>POMS confusion</td>
<td>5.33 (2.4)</td>
<td>4.33 (2.5)</td>
<td>5.42 (3.9)</td>
<td>7.17 (2.1)</td>
</tr>
<tr>
<td>POMS depression</td>
<td>6.92 (9.3)</td>
<td>6.17 (7.2)</td>
<td>5.58 (6.8)</td>
<td>9.83 (6.8)</td>
</tr>
<tr>
<td>POMS fatigue</td>
<td>8.67 (7.2)</td>
<td>7.16 (6.4)</td>
<td>7.00 (4.1)</td>
<td>9.00 (6.4)</td>
</tr>
<tr>
<td>POMS vigor</td>
<td>15.17 (6.0)</td>
<td>17.75 (6.4)</td>
<td>16.58 (4.1)</td>
<td>14.17 (7.3)</td>
</tr>
<tr>
<td>POMS tension</td>
<td>10.91 (8.4)</td>
<td>7.58 (7.3)</td>
<td>10.83 (6.3)</td>
<td>10.50 (3.7)</td>
</tr>
<tr>
<td>POMS total mood disturbance</td>
<td>21.23 (29.4)</td>
<td>10.83 (28.1)</td>
<td>17.67 (23.3)</td>
<td>27.17 (19.5)</td>
</tr>
<tr>
<td>PANAS positive</td>
<td>32.91 (7.8)</td>
<td>35.00 (8.1)</td>
<td>32.3 (8.1)</td>
<td>30.8 (6.0)</td>
</tr>
<tr>
<td>PANAS negative</td>
<td>15.00 (5.4)</td>
<td>14.42 (5.9)</td>
<td>16.9 (8.0)</td>
<td>17.8 (5.6)</td>
</tr>
<tr>
<td>BES physical condition</td>
<td>24.58 (6.9)</td>
<td>32.3 (4.3)</td>
<td>31.4 (3.6)</td>
<td>25.3 (8.2)*</td>
</tr>
<tr>
<td>BES sexual attractiveness</td>
<td>42.17 (5.8)</td>
<td>45.75 (9.2)</td>
<td>44.7 (5.9)</td>
<td>43.7 (6.1)</td>
</tr>
<tr>
<td>BES weight concern</td>
<td>23.58 (6.2)</td>
<td>30.91 (8.2)</td>
<td>30.5 (6.7)</td>
<td>23.5 (4.2)*</td>
</tr>
</tbody>
</table>

*Note:* *Group differences at post-treatment are significant at $p \leq 0.05$.

Numbers in parenthesis are standard deviations.
body parts that are evaluated as part of this subscale. Additionally, exercise alone may be insufficient to alter sexual attractiveness, and perhaps, a combined intervention of exercise, relationship issues and programs that focus on the use of cosmetics may improve sexual attractiveness in a breast cancer population.

Although distress scores did not significantly change over the 12-week program, the EG showed a reduction in distress on their POMS and PANAS Negative scores, while the CG increased their distress. The initial small sample size and the dropout rates in both conditions severely affected our power to find statistically significant differences. It is possible that if we had been able to recruit and retain our planned sample size ($N = 30$), we may have been able to detect significant improvements in distress among EG participants. Further, we did not specifically recruit distressed subjects, and hence, our effect size for distress changes may have been limited by a floor effect.

Out pre-to post-treatment physiological data in the EG suggest cardiovascular fitness improvements following participation in a supervised exercise program. Exercise training has been shown to be an effective blood pressure reducing agent and indicative of improved cardiovascular functioning in many populations, including small samples of patients treated for cancer (Dimeo et al., 1997a; MacVicar et al., 1989). In the present study, significant reductions in systolic and diastolic blood pressure were noted at baseline and at submaximal workloads reflecting an increased efficiency of the cardiovascular system. Although there were no significant changes in resting heart rate or peak watts, significant improvements in submaximal heart rate and blood pressure such as those observed are indicative of exercise training effects in any population. Unfortunately, we were not able to persuade the CG participants to return for in-person assessments at 12 weeks; hence, we cannot rule out the possible influence of familiarity and comfort with the exercise stress tests at post-assessments in the EG.

The study limitations include a small sample of all white volunteers and difficulties with retention of control participants. Despite community and local outreach efforts, we were limited in our ability to recruit a larger sample. This may reflect that on-site exercise programs (with associated scheduling and transportation costs) may not be attractive to potential participants (18% of telephone contacts). As noted earlier, 18% of individuals who expressed an interest in the study were excluded for medical reasons. Although safety concerns restricted our ability to include women with hypertension and diabetes, other researchers may wish to include these women and consider having a physician present or on call during exercise sessions. With regard to retention of control participants, although our participants were offered a wait-list program (three women chose this option and none of them continued with the 12-week program), it was difficult to elicit their attendance at post-assessments, particularly post-assessment peak stress tests. Although we assessed weight at baseline, because very few control participants agreed to return for post-assessments exercise stress tests, we were unable to compare changes in weight across groups. This points to the need to provide a ‘placebo’ control condition to enhance subject retention and/or provide larger incentives for completing assessments. Finally, the study design did not allow us to separate the effects of exercise from nonspecific aspects of group support since a group-based control condition was not utilized.

Although numerous studies reveal the multitude of physical and psychological benefits that can be derived from regular participation in physical activity, most women remain sedentary or irregularly active (USDHHS, 1996). Women who have had breast cancer may have much to gain by taking up a regular program of physical activity. Our results suggest that a 12-week exercise program contributed to improved body image among breast cancer survivors. There is a need for studies examining distress, body image and fitness level changes in a larger sample with sufficient power to detect differences, more intensive methods of subject recruitment and efforts to retain participants in the control arm. Future research should also address a number of questions in this developing area of research on the role of exercise in improving recovery from cancer (e.g. Pinto and Maruyama, 1999). For example, it is not currently known which type, amount and frequency of exercise is most beneficial for specific outcomes such as improvement of mood, fatigue, or body image; nor is it known which type of exercise(s) is most likely to be adopted and maintained among women treated for breast cancer.
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REFERENCES


