THE EFFECTS OF AN INTEGRATED EXERCISE AND RECREATION THERAPY INTERVENTION ON BREAST CANCER SURVIVORS

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ABSTRACT

JAMIE LYNN PEARSON: The Effects of an Integrated Exercise and Recreation Therapy Intervention on Breast Cancer Survivors
(Under the direction of Dr. Claudio Battaglini)

Researchers investigated effects of a 20-week integrative intervention (IIG) assessing the physical and psychosocial health of breast cancer survivors. This retrospective study included 70 survivors randomized into 4 groups: IIG, exercise only (EX), recreation therapy only (RT), or control group (CO) and assessed at baseline, week 8, and post intervention. Three days a week the IIG exercised at low to moderate-intensity 60 minutes, and recreation therapy 30 minutes, EX did exercise only, RT did recreation therapy only and the control group, no intervention for the first 8 weeks. Following week 8 assessments, all groups received IIG intervention. Results revealed that the IIG promoted positive changes in cardiorespiratory function ($p= .001$), muscular fitness ($p\leq.0005$), fatigue ($p\leq.0005$), and quality of life ($p= .001$) within the first 8 weeks of a 20-week rehabilitation program. In conclusion, a combined exercise and psychosocial intervention promotes improvements in physiological and psychological needs of breast cancer survivors.

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CHAPTER I

INTRODUCTION

Cancer is the overall number two cause of death in women and breast cancer is the second most common type of cancer that accounts for nearly 28% of women being diagnosed in the United States (American Cancer Society, 2011). Due to early detection and advancements in medical treatments, the number of breast cancer survivors in the United States has grown tremendously during the past decade (NCI, 2011). However, from the initial diagnosis to completion of all cancer treatments, breast cancer survivors generally experience a multitude of disease and treatment-related side effects that can negatively impact physical and psychological function. In many cases, the harm from receiving a cancer diagnosis and the harsh nature of anti-cancer treatments, lead breast cancer survivors to experience diminishing physical and mental health. If not addressed, significant reductions in quality of life can occur, and perhaps chances for a better prognosis may become compromised (Battaglini, et al., 2006).

Complementary therapies have recently received more attention by the medical community as a means to alleviate cancer treatment-related side effects, while promoting better health and longevity, and enhancing the overall quality of life of cancer survivors. Among many therapies recently utilized by health care providers, scientific evidence has

shown that exercise is an efficient and cost-effective intervention in mitigating numerous side effects of cancer treatment and promoting positive changes in many physiological and psychological domains in cancer survivors. Improvements in cardiorespiratory function, muscular strength, overall quality of life and reduction in anxiety, depression and fatigue, have been consistently reported in the literature (Battaglini et al., 2007; Courneya et al., 2007; Courneya et al., 2008; Dimeo, F., Stieglitz, R., & Novelli-Fischer, U. 1999; Galvao, D.A. & Newton, R. U. 2005). However, exercise alone may not address all issues of psychosocial decline commonly observed during and post-treatment. Reduced ability to focus, constant stress due to uncertainty of the future and fear of a cancer re-occurrence are issues that can significantly reduce quality of life, negatively impacting the overall health of cancer survivors. To date, studies examining the integration of interventions aimed to address physical and psychological needs of breast cancer survivors are scarce. Therefore, the exploration of the effects on an integrative and individualized intervention, focused on addressing both the physical and psychosocial needs of breast cancer survivors should be evaluated.

Statement of the Purpose

The purpose of this retrospective study was to examine whether an integrative intervention (IIG group) promotes positive changes on cardiorespiratory function, overall muscular fitness, body composition, fatigue, depression and quality of life in breast cancer survivors during the first eight weeks of a 20-week intervention. The secondary purpose was to compare the effects of the first eight weeks of the integrative intervention to the first eight weeks of an exercise only intervention (EX group), recreation therapy only intervention (RT group), and a control, no intervention (CO group) on the selected physiological and

psychological parameters cited above. After the first eight weeks of the study intervention, breast cancer survivors in all groups received the integrative intervention (IIG) for the remainder of the study (12 weeks). Therefore, the tertiary purpose of the study was to examine changes in all groups from baseline to completion of the 20-week study, on the aforementioned study outcomes. Comparisons between groups will also be explained. It is important to clarify up front that the control group underwent a baseline assessment at the initial intake. After 8 weeks of receiving no treatment they had the same battery of tests. After the second assessment on week 8, the control group along with the other 3 groups received the integrated intervention. After 8 weeks of intervention, the control underwent their 8-week assessment (which took place at week 16 of the study). The final assessment for the control group was at week 28. Although the study was only a 20-week study, the control group ultimately received 20 weeks of intervention following the first 8 weeks of receiving no treatment.

Research Questions:

R1. Does an integrated intervention promote positive changes in cardiorespiratory function (estimated VO_{2max}), muscular fitness (Overall Muscular Endurance), body composition (% Body fat), fatigue, depression and quality of life in breast cancer survivors during the first 8 weeks of a 20-week rehabilitation program?

R2. Does the integrated intervention promote greater positive changes in cardiorespiratory function (estimated VO_{2max}), muscular fitness (Overall Muscular Endurance), body composition (% Body Fat), fatigue, depression and quality of life in breast cancer survivors when compared to an exercise only intervention, recreation therapy only intervention, and to a control no intervention group during the first 8 weeks of a 20-week rehabilitation program?

R3. Will there be a positive change in cardiorespiratory function (estimated VO_{2max}), muscular fitness (Overall Muscular Endurance), body composition (% Body fat), fatigue, depression and quality of life in breast cancer survivors from baseline to completion of a 20-week intervention within each of the groups (IIG, EX, RT, C)?

R4. Will there be a positive change difference in cardiorespiratory function (estimated VO_{2max}), muscular fitness (Overall Muscular Endurance), body composition (% Body fat), fatigue, depression and quality of life in breast cancer survivors from baseline to completion of a 20-week intervention between the groups (IIG, EX, RT, C)?

Hypotheses:

H1. There will be significant positive changes in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life in the IIG group after the initial 8 weeks of the 20-week study protocol.

H2. There will be a significant difference in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes between the IIG group and the EX, RT, and CO groups during the first 8 weeks of the 20-week study protocol, with the IIG group experiencing the greater changes in all above mentioned physiological and psychosocial parameters.

H3. There will be significant differences in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes within each of the groups (IIG, EX, RT, and CO) from baseline to completion of the 20-week intervention period in which all groups will receive the integrated intervention (IIG).

H4. There will be no significant differences in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes between the groups (IIG,

EX, RT, and CO) from baseline to completion of the 20-week intervention period in which all groups will receive the integrated intervention (IIG).

Operational Definitions:

1. **Biofeedback:** Biofeedback is a method of learning to voluntarily control and maintain physiological functions such as heartbeat, blood pressure, and muscle tension with the feedback provided by a computer system (Institute of HeartMath®, 2008). Therapists use this method to help control pain, improve mood, decrease anxiety, reduce stress, and improve autonomic nervous system function.
2. **Breast Cancer Survivors:** Women between the ages of 25-75 years who had confirmed diagnosis of Stage I, II, or III invasive breast cancer and have completed all planned surgery, radiation therapy, and chemotherapy within the past six months.
3. **Get REAL & HEEL Program:** Get REAL & HEEL is a unique program designed to serve breast cancer survivors in North Carolina. Get REAL & HEEL provides an integrative individualized exercise prescription with recreational therapy to provide a program that strengthens mind and body alike. An individualized plan is created to help in the management of cancer treatment-related symptoms and improvement of longevity and quality of life.
4. **Integrated Intervention Group (IIG) (first 8th weeks):** the first 8 weeks the psychosocial intervention consists of introducing the concept of the mind/body relationship and the four basic HeartMath techniques. Biofeedback is used to help see the heart rhythm response of the techniques. The exercise treatment included a warm up, cardiovascular and resistance training cool down/stretching.

5. **Integrated Intervention Group (IIG) (Last 12th weeks):** After 8 weeks, for the remaining 12 weeks the recreation therapy involves biofeedback as well as other recreation activities described under the recreation therapy intervention. The exercise treatment included a warm up, cardiovascular training, resistance training and a cool down/stretching.
6. **Overall muscular endurance (OME):** a composite variable created to quantify muscular fitness; the summation of the number of repetitions performed for the following exercises: modified push-ups, partial curl-ups, biceps curls (both arms), lat-pulldown, leg-extension, and leg curl.
7. **Recreational Therapy with emphasis on emotional well-being, stress management, and coping skills:** is a treatment service that provides counseling, treatments and recreation activities to individuals with illnesses or disabling conditions to improve or maintain physical, mental and emotional well-being and help reduce depression, stress and anxiety. Includes pain and stress management, relaxation techniques, mindfulness training, individual leisure education, group activities such as ropes challenge course, expressive arts and group leisure education.

Delimitations:

1. Participants for the study included 70 women who participated in the Get REAL & HEEL After Cancer Care Program from 2008 to 2011.
2. Due to the need to attend the program 3 days per week for 5 months, participants included women who lived in North Carolina and were within a reasonable driving distance from the center.
3. All participants were breast cancer survivors.

4. All participants had completed their major cancer treatments and surgeries within six months of starting to participate in the study.
5. All participants were women between the ages of 25 and 75 years old.
6. All the participants were cleared by their medical oncologist or primary physician prior to enrolling in the study, and had no major health issues that precluded their ability to engage in low to moderate exercise training.
7. The time frame of the intervention was 20 weeks (part I: 8 weeks, part II: 12 weeks) for the IIG, EX, RT only groups. The time frame of the intervention was 28 weeks for the C group (part I: 8 weeks no intervention, part II: 8 weeks integrated program, part III: 12 weeks integrated program)

Assumptions:

1. Breast cancer survivors were honest when filling out their patient rated outcomes (PRO's).
2. The effect of different cancer treatments did not alter the participants' exercise responses.
3. All breast cancer survivors strictly adhered to all of the pre-assessment guidelines given to them.
4. Breast cancer survivors did not alter their dietary practices during the study.
5. The no treatment, control group did not participate in any systematic exercise during the first 8 weeks of the study protocol.

Limitations:

1. This was a retrospective study and data collection procedures could not be altered.

2. This study included early stage breast cancer survivors who had completed their treatment within six months and therefore can only be generalized to this population.
3. There was a wide age span between participants (25-75 years).
4. The different treatment regiments that breast cancer survivors underwent prior to the study could influence their exercise response.
5. This study did not include the male population of breast cancer patients.

Significance of the Study

With breast cancer survivors living longer there is a need for making life more pleasant and manageable. As side effects of breast cancer and breast cancer treatment are an inevitable issue, the study of various treatments for these side effects has gained more attention in oncology. Exercise has been studied as a potential intervention to assist in mitigating some of these treatment-related symptoms. However, exercise does not address the whole body (both physical and psychosocial) issues that may be experienced by the majority of breast cancer survivors. Studies that attempted to examine an integrative intervention that addresses both physical and psychological approach are scarce. Therefore, it is imperative that research continues to explore the best possible integrated intervention model(s) designed to cope with the combined physical and psychosocial issues lived by breast cancer survivors. In doing this, the goal of this study is to contribute to the current research in exercise oncology and to help narrow the best treatment(s) along with the time frame necessary to see significant improvements in overall physical and psychosocial well-being in breast cancer survivors.

CHAPTER II

REVIEW OF LITERATURE

For the purpose of organization this chapter has been divided into the following sections: a) introduction to cancer etiology; b) breast cancer etiology; c) common breast cancer treatments and related side effects; d) effects of exercise on the management of breast cancer treatment-related side effects; e) effects of recreation therapy on the management of breast cancer treatment-related side effects; f) summary.

a)Introduction to Cancer Etiology

Cancer is used to define over 100 different diseases all describing some variation of abnormal cell division. The normal lifecycle of a cell starts with new cell division that occurs when the new cell either gets old or damaged. The cell dies and is replaced by newer cells. However, some cells may become damaged and instead of dying cause mutations which affect the normal process. When this occurs masses of tissue can accumulate causing tumors in the body. Tumors can be either benign (not cancerous) or malignant (cancerous). Benign tumors can sometimes cause issues when they grow large and may put pressure on organs; however they do not invade other tissues or spread throughout the body. Malignant tumors are dangerous and life threatening. They can spread through the body and invade other tissues. Some cancers, such as leukemia rarely form tumors. The cause of cancer is

uncertain; however there are some environmental concerns that may cause cell damage, such as cigarette smoking (ACS, 2008; NCI, 2007).

There are many different forms of cancer that can be divided into subgroups: Carcinoma (skin), Sarcoma (bone, cartilage, fat, muscle, blood vessels, supportive tissue), Leukemia (bone marrow, blood), Lymphoma & Myeloma (immune system), and central nervous system (brain and spinal cord) (ACS, 2008; NCI, 2007). The type of cancer is named from where it originates. Most often as cancer reaches the latter stages it will spread to other organs but will still be called by the original form.

Not only does cancer have various forms but there are also stages. The NCI's surveillance, epidemiology, and end results program (SEER) groups cancer into five categories: a) In situ- when abnormal cells are only found in the original layer, b) localized- when cancer is limited to the organ, c) regional- usually involves spread into nearby organs or lymph nodes, d) distant- spread to organs and lymph nodes not close to the original site, and e) unknown- there is not enough information to determine. There are also stage classifications 0-IV depending on the degree of the cancer and how much has spread throughout the body (NCI, 2007).

In 2011 it is estimated that there will be roughly 1,596,670 new cases and 571,950 deaths from cancer in the United States. Cancer is the second leading cause of death just after cardiovascular disease, taking nearly 1 in 4 lives (Cancer Statistics, 2011). In some forms of cancer such as breast cancer, survival rates are increasing due to early detection and improved medical diagnosis and treatment. These improvements in death rate give hope to those diagnosed; however they do not come free of issues.

b)Breast Cancer Etiology

Breast cancer is more specifically defined as the abnormal growth of cells in the breast tissue. The two main types of breast cancer are ductal carcinoma and lobular carcinoma. Ductal is the most common and is formed in the ducts (tubes) of the breast that transport the milk to the nipple. Lobular is formed in the lobules or the area of the breast that produce the milk. Breast cancer is a form of cancer that men can also develop, however, it is not nearly as common and therefore most research focuses on women (American Cancer Society, 2008; National Cancer Institute, 2007).

Breast cancer is also divided into stages 0-IV depending on the severity of the cancer. Stage 0 is the earliest stage of breast cancer and describes abnormal cells either found in the ducts or lobules of the breast. At this stage treatment may involve mastectomy or lumpectomy and radiation. Stage I is when the tumor is less than two centimeters and the cancer has not yet spread to surrounding tissues. Stage II is classified when either: a) the tumor is less than two centimeters and has spread to lymph nodes in the underarms, b) the tumor is 2-5 cm and may have spread to the lymph nodes or, c) the tumor is larger than 5 cm and has not spread. In breast cancer (stages I and II), treatment usually involves lumpectomy or mastectomy, radiation and possible lymph node removal. There may also be situations when the physician recommends chemotherapy in these earlier stages. Stage III breast cancer has three subcategories: IIIA, IIIB, and IIIC. Stage IIIA is when a tumor has spread to the lymph nodes under the arms. Stage IIIB is when the tumor has spread to the skin and surrounding chest wall and lymph nodes under the arms and behind the breastbone. Stage IIIC is the same as IIIB but may also spread to the lymph nodes above or below the collarbone. Any of the stage III categories usually involve surgery, chemotherapy, and possibly hormone therapy. Stage IV breast cancer is when the cancer has spread throughout

other areas of the body (metastasized). To treat stage IV cancer may involve surgery, chemotherapy, radiation, hormonal therapy or some combination of those. Many women will also take Tamoxifen following treatments to help block estrogen, and may decrease recurrence (NCI, 2007; ACS, 2008).

Breast cancer is the second most common form of cancer accounting for almost 30% of women being diagnosed today. There are approximately 232,620 new cases estimated for 2011 and of those, 39,970 do not survive (Cancer Statistics, 2011). Although there is a large prevalence of new cases and deaths concerning breast cancer, there has been an increase in 5-year relative survival rates to about 90% (Cancer Statistics, 2011). While this is great news for survivors, the improved longevity also brings with it the side effects from the diagnoses and harsh anti-cancer treatments.

c) Common Breast Cancer Treatments and Related Side Effects

As mentioned above the main forms of treatment for breast cancer are individualized depending on the stage and classification of the breast cancer and whether it is sensitive to certain hormones (NCI, 2007). The main treatments offered include: surgery (lumpectomy, mastectomy), chemotherapy, radiation, and hormonal therapy (ACS, 2008). Surgery will remove cancerous tissue. More specifically a lumpectomy removes a lump found in the breast and a mastectomy will remove part of, or in severe cases, the whole breast(s). Chemotherapy uses drugs to kill the cancer cells while radiation destroys cancerous tissue. Hormonal therapy is usually given to women who have ER-positive breast cancer. Therapies such as Tamoxifen block certain hormones, in this case, estrogen, from fueling cancer growth. Although many of these treatments are necessary to improve survival rates, the harsh nature of them brings on many debilitating side effects. Well-known side effects are

primarily physical, however this disease and the treatments produce many psychological and functionality issues as well.

Surgery causes obvious physical changes of the breast size and shape; it will often compromise the range of motion in the arm, shoulder and chest on the side where the surgery took place (Gosselink et al., 2003; Lauridsen, et al., 2008). Any surgery runs the risk of infection developing at the incision and/or fluid buildup at the surgical site (ACS, 2008). Chemotherapy is a harsh treatment that often results in nausea, vomiting, and hair loss, decreased white blood cell count, mouth sores and loss of appetite (ACS, 2008; Zacharia et al., 2007). Some forms of chemotherapy have also resulted in myocardial fibrosis (Renzi et al., 1992), which is a thickening of the heart valves, and injury or death to myocytes (Billingham et al., 1977), which may lead to decreased flexibility and eventually heart failure. Radiation therapy, which destroys cancerous tissue, and at times surrounding healthy tissue, may decrease neuromuscular efficiency (Monga et al., 1997) and cause mitochondrial degeneration (Hsu, et al., 1998). Other side effects from radiation are the damage of healthy cells in surrounding areas, changes and irritation to the skin, lymphedema, and swelling of the breast tissue (ACS, 2008; NCI, 2007). Hormonal therapies may cause blood clots, stroke, uterine cancer and cataracts along with menopause-like symptoms such as hot flashes, leg cramps, joint pain and vaginal dryness (NCI, 2008; Buijs, et al., 2006). Physical side effects most commonly studied throughout the literature are: decrease in cardiorespiratory endurance, muscular fitness, and negative changes in body composition (Battaglini et al. 2005)

Although the physical side effects of breast cancer treatments generally receive more attention, there are numerous psychological issues associated with treatments. Some of these

side effects include extreme fatigue, depression, fear of recurrence and death, anxiety, and decreased overall quality of life (Battaglini et al., 2008; Courneya & Friedenreich, 1999; Dimeo et al., 1999; Korstjens, et al., 2006; Longman, Braden, & Mishel, 1999; Montazeri, 2007).

The most common physical and psychological side effects of breast cancer treatments reported in the literature include: decrease in cardiorespiratory endurance, muscular fitness, and negative changes in body composition, debilitating fatigue, and depression (Adamsen et al., 2004; Battaglini et al. 2005; Battaglini et al., 2006; Dimeo, 2001; Minton & Stone, 2008; Mock et al., 2005; Piper et al., 1987; Ream & Richardson, 1999). These side effects can last years post anti-cancer treatment effecting functionality and overall quality of life of the breast cancer survivor. Pharmaceuticals are often prescribed to relieve some acute side effects, however these are only temporary, can be very expensive, and often have other side effects associated with them. As a result, the medical community is seeking alternative forms of therapy that can be utilized in the mitigation of cancer treatment side effects. Exercise is an alternative therapy that has been shown to be an efficient and cost-effective intervention aimed to alleviate treatment-related symptom in cancer survivors (Courneya et al. 2008; Galvao & Newton, 2005; Jones et al. 2011; Mutrie, et al. 2007; Schmitz et al. 2010; Stieglitz, R., & Novelli-Fischer, U. 1999). However exercise alone may not address all body and mind aspects associated with the disease and its treatments. Therefore, the exploration of the effects on an integrative and individualized intervention, focused on addressing both the physical and psychosocial needs of breast cancer survivors is imperative. Recreation therapy has been explored as an alternative therapy in reducing more psychological treatment related side effects (McGhee & Skalko, 2001; Winningham, 1991; National Council for Therapeutic

Recreation Certification, 2004; Sugermann, D., Doherty, K., & Garvey, D., 2000; Groff et al., 2008). These two alternative therapies may help in providing a more cost effective, long term relief in diminishing the debilitating physiological and psychological side effects associated with breast cancer treatment.

d)Effects of Exercise on the management of breast cancer treatment-related side effects

As mentioned above, exercise has been shown to mitigate many breast cancer treatment-related side effects (Winningham, 1991; Dimeo et al., 1997; Courneya et al., 2003; Galvao & Newton, 2005; Kerry et al., 2007). The primary physical components studied in past research have focused on the effects of exercise on cardiovascular function (VO_{2max}), muscular fitness (overall muscular endurance), and body composition (body fat percentage). These three components will be the focus of this section of the review of literature. Exercise intervention studies have found that exercise training may increase muscle formation and protein synthesis, enhance energy production, improve appetite, stimulate red and white cell production and improve immune function (Segal et al., 2001). Performance may also improve due to exercise. Improved cardiovascular function (increased VO_{2max}), increased blood volume and hemoglobin levels and decrease in fatigue may result from cardiovascular training (Dimeo et al., 1997). Resistance training will improve body composition, overall muscular fitness and strength (DeBacker et al., 2007; Cheema & Gaul, 2006). By improving overall cardiovascular function, muscular fitness and body composition, breast cancer survivors improve functionality. By improving functionality, activities of daily living such as walking, brushing hair and doing laundry will also help women feel more empowered and self-sufficient and in turn improve their overall quality of life. Cardiovascular and resistance training will help improve body composition and decrease fat mass, which may cause a

reduction in development of cardiovascular disease. Many breast cancer survivors experience increases in fat mass with a decrease in muscle mass (a term called sarcopenic obesity) due to inactivity. Sarcopenic obesity can increase the risk of other chronic diseases such as diabetes and cardiovascular disease. Increased fat cells can also release estrogen, which may produce estrogen tumors (Stenholm et al., 2009). By decreasing this fat mass, breast cancer survivors may also decrease their rate of recurrence, and thus improve longevity (Schmitz et al., 2011).

In a meta-analysis conducted by McNeely and colleagues, researchers analyzed 14 different studies to determine the effects of exercise on breast cancer survivors, and the benefits in mitigating side effects of breast cancer treatment. They focused only on randomized controlled trials for their analysis. Sample sizes of most of the studies were small with some heterogeneity of exercise treatments. Cardiorespiratory function (VO_{2max}), physical functioning, and decreasing fatigue, were three areas that exercise had the most statistically significant improvements, however all variables that were studied did have improvements (McNeely et al., 2006).

Courneya and colleagues analyzed the impact of a 15-week aerobic training program on the VO_{2max} of 53 breast cancer survivors. Survivors, with a mean age of 59, were randomly assigned to either an exercise (n=25) or a control group (n=28). They participated in baseline testing, one of those being a VO_{2max} test. A control group received no exercise treatment, while the exercise group performed supervised cardiorespiratory exercise at 70-75% of their predicted VO_{2max} on a cycle ergometer, three times a week for 15-35 minutes per session. At the end of the 15 weeks, final assessments were taken. The results of the study determined that the mean difference in VO_{2max} between the groups was .29 L/min, and

the difference of the change scores between groups was significant ($p < .001$). VO_{2max} increased by .24 L/min in the exercise group and it decreased by .05 L/min in the control group. The researchers also found that improved oxygen consumption was correlated with increased quality of life (($r = 0.45$; $P < .01$) in these breast cancer survivors (Courneya et al., 2003).

Herrero and colleagues developed a pilot study to determine the effect of a combined cardiovascular and resistance training intervention on various physiological parameters. The study duration was 8 weeks, and sixteen breast cancer survivors were randomly assigned to either a control group (n=8), or a treatment group (n=8). The treatment group participated in combined cardiovascular and resistance training exercise 3 times a week for 90 minutes. The control group maintained usual care and refrained from systematic exercise. After 8 weeks of exercise, VO_{2max} in the exercise group increased an average of 3.9 ml/kg/min., which was significantly different from their baseline measures ($p < .05$). In addition, there were no significant differences in pre to post VO_{2max} measurements in the control group (Herrero et al., 2006).

Schneider and colleagues presented the effects of exercise training on the cardiopulmonary function of breast cancer survivors including post treatment survivors or women currently undergoing some form of treatment. This study included 113 women diagnosed with breast cancer that were randomly assigned to one of two groups: women undergoing treatment exercise group (n=17) or a women post-treatment exercise group (n= 96). Baseline measures including: heart rate, blood pressure, predicted VO_{2max}, time on treadmill, and oxygen saturation was assessed while undergoing a 3-minute stage Bruce Protocol Test. The individualized exercise intervention was administered 2 to 3 times a week

for 6 months. Each exercise session was approximately 60 minutes long and included a 10-minute warm-up, 40 minutes of cardiovascular and resistance training, and a 10-minute cool-down and stretch. Exercise intensity for the cardiovascular work was based on 40–75% of the participants' maximum heart rate, calculated by the Heart Rate Reserve (HRR) method. Resistance training included total body exercises at a moderate intensity. Post intervention measurements were taken at the conclusion of the six-month intervention. The results suggested that those participants undergoing treatment only had significant differences in systolic blood pressure and time on the treadmill, from baseline to final measurements. However, breast cancer patients in the post-treatment group showed statistically significant reductions in systolic blood pressure, diastolic blood pressure, and resting heart rate ($p < .05$) accompanied by improvements in predicted VO_{2max} and time on the treadmill ($p < .05$). These results imply that exercise improves cardiovascular function, and may be more beneficial post treatment, rather than while an individual is undergoing cancer treatment (Schneider et al., 2007).

Courneya was one of the early researchers to address the relationship between exercise and quality of life in a group of 52 post-menopausal women, post-cancer treatment. Participants were assigned into either an exercise group (n=25) or a usual care control group (n=25) for a 15-week study protocol. The exercise group received supervised exercise on a cycle ergometer for 15-35 minutes, at approximately 70-75% of VO_{2max}, three days a week. The usual care group did not receive any exercise intervention. The FACT-B quality of life assessment was taken prior to the intervention and then again at the conclusion of the intervention. The results of the study indicated that the exercise group achieved significantly

greater improvements in quality of life ($p < .001$) from pre to post intervention than the usual care control group (Courneya et al., 2003).

Milne and colleagues reported the relationship between exercise and overall quality of life in a group of West Australia breast cancer survivors. In this study, breast cancer survivors, (n=558) who had recently completed adjuvant therapy, completed the Functional Assessment of Cancer Therapy-Breast (FACT-B) quality of life scale survey and the Godin Leisure Time Exercise Questionnaire (GLTEQ). The results showed that only 31% of breast cancer survivors were meeting the recommended physical activity requirements post-treatment. Those breast cancer survivors, who met physical activity requirements, scored significantly higher ($p < .001$) on the FACT-B quality of life scale than the inactive breast cancer survivors. The researchers concluded that although the research involved questionnaires and not treatment groups, it appeared that greater physical activity post cancer treatment was associated with an increased quality of life in breast cancer survivors (Milne, et al., 2007).

Also in 2007, Daley and colleagues analyzed the effects of aerobic exercise therapy on quality of life in post-treatment breast cancer survivors. 108 women who had been treated for breast cancer within 12 to 24 months were randomized into one of three groups: aerobic exercise therapy (n=34), exercise-placebo (n=36), or usual care control (n=38). The aim of this study was to determine whether changes in overall quality of life during an exercise intervention were due to the exercise or simply due to the increased attention that patients received. Prior to the intervention, a baseline assessment of quality of life (including FACT-B) was completed. Following the initial assessment, the aerobic exercise group participated in an eight-week exercise intervention consisting of 50 minutes of cardiovascular exercise,

three days a week, at a moderate intensity around 65%-85% of their age-adjusted maximum heart rate and a rating of perceived exertion (RPE) of 12 to 13. The exercise-placebo group participated in eight weeks of supervised passive stretching for 50 minutes, three days a week, during which heart rate was maintained below 40% of heart rate reserve, and no additional counseling was given. The usual care group received no treatment. At the conclusion of the eight-week intervention, quality of life was measured again using the FACT-B scale. The results showed a significant difference ($p = .002$) between the baseline and the final assessment of quality of life scores within the aerobic exercise group, but not within the exercise-placebo, or usual care group, thus concluding that the quality of life differences were related to the effect of exercise (Daley et al., 2007).

Another study done by Milne and colleagues in 2008 consisted of a treatment-based study to gain more understanding of the relationship between exercise and quality of life. Fifty-eight breast cancer survivors, all whom were within two years of completing adjuvant therapy, were assigned randomly to an immediate exercise group (IEG; n=29) or a delayed exercise group (DEG; n=29). The immediate exercise group completed a 12-week intervention, three days per week, including both aerobic and resistance training. The delayed group completed the exercise program the 12 weeks following the immediate group. The FACT-B questionnaire was used to assess quality of life at baseline and weeks 6, 12, 18, and 24 in both groups. The results of the study were determined by an omnibus analysis of variance, which found the quality of life in the immediate group was significantly higher ($p < .001$) than the quality of life in the delayed group from baseline to 12 weeks (mean group difference 26.1 points). In addition, the increase in quality of life in the delayed group for weeks 12-24 (29.5 points) was significantly greater than the week 12-24 increase in quality

of life in the immediate group (6.5 points; $p < .001$). The rapid improvements in the delayed group's quality of life once they began exercise training, together with the plateau of the immediate group's quality of life upon completion of exercise treatment, led the researchers to postulate that consistent exercise is vital to improving overall quality of life in breast cancer survivors (Milne et al., 2008).

Pinto and others studied the impact of a home-based physical activity program on factors such as overall physical activity and fatigue in breast cancer patients. Eighty-six women (with a mean age of 53 years) who varied in stages 0 to II of breast cancer and had completed all necessary treatments were randomly assigned to either a physical activity group or a usual care control group. The participants in the physical activity group received 12 weeks of exercise counseling over the phone plus weekly exercise tips and instructional handouts. A battery of assessments (including the FACT-B fatigue scale) was administered at baseline, at the end of week 12, and at follow-ups 6 and 9 months following baseline. At week 12 and during both follow up assessments, the physical activity group reported less fatigue than the control group ($p \leq .0005$). Researchers hypothesized that a home-based exercise program can be effective in alleviating negative side effects such as cancer treatment related fatigue (Pinto et al., 2005).

Cancer treatment-related fatigue in post-treatment breast cancer survivors is one of the most prevalent side effects. In a study done by Alfano and colleagues, a prospective analysis on breast cancer survivors was done to determine the relationship between exercise and numerous variables, one of those being cancer related fatigue. The sample size was large, consisting of 545 post-treatment breast cancer survivors who on average were six months post-diagnosis. The women were assessed in person or via telephone at the

beginning of the study (a retrospective report of pre–cancer physical activity), at 29 months post-diagnosis (post-diagnosis physical activity questionnaire), and at 39 months post-diagnosis (fatigue, pain, hormone symptoms, and quality of life questionnaires). Patient's who reported greater pre- and post-diagnosis physical activity also reported significantly less cancer related fatigue ($p < .01$). Moderate to vigorous physical activity rather than light activity or household activity was found more effective in minimizing cancer-related fatigue. The prospective analyses suggested that breast cancer survivors could decrease cancer-related fatigue and improve functionality when participating in regular activity (Alfano et al., 2007).

Dimeo and coworkers explored the effects of a combined aerobic and resistance training exercise intervention on persistent cancer-related fatigue in post-treated cancer survivors. Thirty-two cancer patients suffering from mild to severe persistent fatigue (scores >25 on the Brief Fatigue Inventory) participated in a three-week exercise program. Prior to participation in the program, as well as immediately after the program, a number of variables were assessed in each of the participants. The exercise protocol consisted of 30 minutes, three days a week of treadmill walking, followed by total body resistance training and coordination exercises. At the completion of the study, significant decreases in global fatigue ($p < .0001$; measured by the Functional Assessment of Cancer Therapy scale) were measured in the treatment group; however no reduction in cognitive fatigue was evident. The extrapolation was that a three-week exercise program is effective in reducing physical aspects of cancer treatment-related fatigue, but not cognitive fatigue. Future research could look into how a longer exercise intervention may possibly improve cognitive fatigue in breast cancer survivors (Dimeo et al., 2008).

e) Effects of recreation therapy on the management of breast cancer treatment-related side effects

While research has revealed exercise therapy as an effective alternative therapy in mitigating many side effects of breast cancer treatment, the results of some studies as well as concerns from experts in the field (Pinto, 2005; McNelley et al., 2006; Battaglini et al., 2006) imply that exercise therapy may not address all the issues associated with the disease and its treatments. Some deeper psychological issues such as stress and anxiety caused by fear of recurrence or death, lack of concentration, cluttering of the mind, and other psychological impairments caused by the diagnosis and treatment of the disease may not be addressed with exercise alone (Battaglini et al., 2006). Therefore, the many people within the medical community are now advocating the use of other complimentary interventions that focus on alleviating these psychological needs as well as the physical needs in the alleviation of cancer treatment related side-effects. A combination of such therapies may even be more efficient than exercise alone in improving quality of life, possibly improving VO_{2max}, and decreasing fatigue and depression. One particular alternative therapy that is receiving more attention in the relief of cancer diagnosis and treatment-related side is recreation therapy.

Recreation therapy, focusing on emotional well-being and stress management is a restorative combination of various forms of recreation and leisure activities, often including components such as adventure therapy (Walsh-Burke, 1992), biofeedback (McKinney et al., 1997), music therapy (McKinney, 2005), creative writing, humor therapy and leisure counseling among other activities (National Council for Therapeutic Recreation Certification, 2004). Recreation therapy helps to improve the individual's recreation and leisure experiences, thus improving the psychological, physiological, social, and emotional health.

More specifically, this is important to the breast cancer survivors suffering from the ill effects of anti-cancer treatment (i.e. VO_{2max}, quality of life, and fatigue) (Battaglini et al., 2006). The literature examining the efficacy of recreation therapy, as an alternative treatment is limited, and predominately qualitative, but many studies focusing on this form of treatment have promising results (McGhee & Skalko, 2001).

Recreation therapy may vary depending on the therapist, the aim of what they want to accomplish through therapy and the individual receiving the therapy. One of the most recent programs used in recreation therapy and gaining interest in the medical community is HeartMath®, a form of biofeedback. Biofeedback is a method of learning to voluntarily control and maintain physiological functions such as heart rhythms and breathing rate, with the feedback provided by a computer system (Institute of HeartMath®, 2008). The signals that are often monitored during biofeedback include brain activity, heart rate, heart rhythm, blood pressure, skin conductance levels, and muscle tension. Therapists use sensors placed on the hands, ears or muscles of the body to provide audible and/or visual feedback about what is happening in the body throughout various lessons. Over time, individuals are able to use these techniques to help in the regulation of involuntary physiological responses. The basic technique of the program is called "Quick coherence," which is a 3 step technique designed to help understand and generate heart rate coherence. Individuals are guided through various stages starting with a focus on the heart, leading into controlled breathing in and out to a count of five, and then shift focus to positive feelings of love and appreciation (The Association for Applied Psychophysiology and Biofeedback, 2007; McCraty et al., 2002).

Heart rate coherence is a measure of emotional stability, mental sharpness, organization, and physiological efficiency in the body. It represents the synchronization of the rhythmic activity of the heart and the harmony between different physiological systems (McCraty et al., 2002; McCraty & Tomasino, 2006). McCraty and Tomasino found that consistent positive emotions led to increased coherence of heart rhythm and greater harmony among physiological systems, while negative emotions such as anxiety and stress triggers more irregular rhythms and decreased harmony among physiological systems (McCraty & Tomasino, 2006). Breast cancer patients who undergo large volumes of psychological and physiological stress may risk decreased heart rate coherence (Lebel et al., 2007; Curess et al., 2000).

Potential psychological benefits of increased heart rate coherence include mental clarity, improved reasoning, feelings of emotional stability, increased well-being and enhanced social functioning (McCraty, 2002). Von Ah and coworkers found (in a study of 54 cancer patients) that increased heart rate coherence and positive emotions, such as optimism, helped improve immune function associated with cancer (decreased Natural Killer Cell Activity) (Von Ah, Kang, & Carpenter, 2007). Increased coherence includes: improved synchronization between the sympathetic and parasympathetic nervous system, increased heart-brain synchronization, respiratory efficiency, cardiac output, and metabolic energy efficiency (McCraty, 2002; Lehrer et al., 2003). Sustained heart rate coherence has also been associated with improved dehydroepiandosterone (DHEA) / cortisol ratios. Improved DHEA/cortisol ratios have been related to reduced stress reactivity and improved homeostasis (McCraty, 2003; McCraty & Childre, 2002).

Heart rate variability is the measure of the naturally occurring beat-to-beat changes within the heart that represents a signal of autonomic function and physiological coherence (Institute of Heart Math®, 2008). Greater heart rate variability is associated with consistent rhythm changes in the heart, while low heart rate variability is associated with, irregular changes. Similar to heart rate coherence, variability is affected is more erratic during negative emotions such as anger and anxiety, and more ordered during positive emotions such as love and appreciation (McCraty & Childre, 2003). The benefits of high heart rate variability and heart rate coherence are similar and may improve immune responses, reason and discernment, and improved cardiovascular responses (Institute of Heart Math®, 2008; McCraty, 2002; McCraty & Tomasino, 2006). Published studies where HeartMath® was employed to assist middle school children, congestive heart failure patients, hypertensive individuals, individuals with HIV, individuals with diabetes, former soldiers with post traumatic stress disorder, and even breast cancer patients (McCraty et al., 1999; Luskin et al., 2002; McCraty, Atkinson, & Tomasino, 2003; Rozman et al., 1996; McCraty, Atkinson, & Lipsenthal, 2000; Ginsberg, Berry, & Powell, 2008). Research involved with HeartMath® is becoming more prevalent and there are many studies impending (Institute of HeartMath®, 2008).

Other forms of biofeedback including two programs developed by the Wild Devine Project: Healing Rhythms (HR) and The Journey to the Wild Devine© (JWD) have also gained increased attention in recreation therapy (The Wild Devine Project, 2009). The HR software is a 15-step biofeedback program that teaches stress management and becoming more mindful of various physiological feelings. The program has three fundamental parts: Self Discovery, Creating Happiness, and Developing Life Skills. The software measures

sweat gland activity as the autonomic nervous system is activated, to acknowledge changes, and control various biofeedback events. Directed rhythmic breathing and total body relaxation helps individuals develop a peaceful mindset and healthy body. The Wild Divine software teaches individuals breathing techniques, "heart breath," for management of stress and emotion. The heart breath technique is comparable to the "Quick Coherence technique in HeartMath®. In Journey to Wild Dive, heart rate and skin conductance levels help the individual to complete a series of biofeedback events, relating to self-awareness. The biofeedback requires the individual to either provoke a state of excitement or relaxation, with the end result of helping the individual better manage such emotions (The Wild Divine Project, 2009).

Journaling and creative writing have been utilized during breast cancer treatment as a form of recreation therapy and may also be a useful therapy in post-treatment patients. There is very little research in this, but some initial studies provide support. Smith and colleagues analyzed the effects of journaling on 43 women shortly following their initial diagnoses with breast cancer. The purpose was to examine the role that expressive writing had on overall mood during a 12-week support group. The journal writing was analyzed by a linguistic inquiry and word counting program. Positive and negative emotion words, average word count, ratio of positive and negative words, and number of entries were all examined. A regression analysis revealed that increased quality of life was associated with a predominance of positive emotion in writing, while increased levels of stress and anxiety after the group intervention were associated with predominance of negative emotion in writing ($p < .05$). It was concluded that additional analyses is needed on journaling and creative writing as a therapy for breast cancer patients. Some topics of interest may include, how often and how

much should patients write, and what should the focus of the writing be? How can breast cancer survivors best utilize journaling as a tool for coping with cancer, and cancer treatment-related side effects (Smith et al., 2005)?

Breast cancer surgery (lumpectomy or mastectomy) can result in the loss of part of or all of the affected breast and surrounding tissue, which is a dramatic event that poses a difficult challenge when considering issues with body image. Some books and articles were analyzed to determine that journaling, has been effective in helping patients come to accept breast alterations post surgery. The conclusion of the case study was to encourage oncology nurses to use journaling and letter writing with breast cancer patients to assist in coping with surgery (Rancour & Brauer, 2003).

Leisure awareness, education, and counseling could also be a beneficial part of recreation therapy. Robertson defines leisure awareness as helping people become mindful of leisure as a positive event that they should incorporate in their lives; leisure education is the process of providing assistance in the discovery of various leisure activities that may be of interest to each individual. Leisure counseling involves understanding barriers to optimal leisure functioning and how to resolve those issues and gain the maximum benefits from the recreation therapy (Robertson, 2004). Leisure counseling may play a key role in increasing the leisure activity. Shannon discovered in her interviews, that although women may understand leisure activities such as the need for exercise, relaxation, etc., they might not implement them in their daily living (Shannon, 2005).

f) Summary

Research has been done to support various exercise therapy interventions and recreation therapy interventions to help breast cancer survivors throughout survivorship.

Exercise therapy interventions improve both physiological as well as some psychological constraints from anti-cancer treatment. However, there are some psychological effects of breast cancer diagnosis and treatment that may need more focused attention and exercise alone may not be sufficient to support. Recreation therapy is associated with improved psychological benefits including stress management and improved emotional wellbeing, and may produce some physiological benefits as well. However, recreation therapy alone may not address all of the physiological detriments occurring in breast cancer survivors due to treatment-related side effects. After reviewing the literature, it is proposed that an individualized, integrated therapy combining both exercise and recreation therapy may be the most comprehensive treatment plan for breast cancer survivors. It is postulated that a combined exercise and recreation therapy intervention would be more successful than an exercise only or recreation therapy only intervention in mitigating both the negative physiological in addition to psychological side effects (decreased VO_{2max}, muscular fitness, and lean body mass, increased fatigue and depression, and decreased quality of life) associated with breast cancer treatment.

CHAPTER III

METHODOLOGY

Experimental Design

Get REAL & HEEL is a rehabilitation program at the University of North Carolina Chapel Hill designed specifically for breast cancer survivors. The program provides assistance in the recovery process, for the breast cancer survivors immediately following the final treatment. The intent is to apply an individualized, integrated exercise and psychosocial therapy protocol to strengthen both the mind and body while improving longevity, such that life might be more pleasant for these survivors.

This study is a retrospective cross over design study using data gathered from breast cancer survivors who participated in the Get REAL & HEEL Breast Cancer research program between the years 2008 to 2011. The Get REAL & HEEL study was a randomized, controlled, 2 phase trial with four groups. The four groups included: an integrated intervention group (IIG), exercise only group (EX), recreation therapy only group (RT), and a no intervention control group (CO). Participants were randomized into one of the four groups at the beginning of the study. Following random assignment into the various groups, all participants underwent a baseline screening battery of physical and psychological assessments. After the completion of the initial 8 weeks of the study (Phase I), all breast

cancer survivors underwent the exact same battery of physical and psychosocial tests. After completing the initial 8 weeks of the study and the battery of assessments, participants from all groups received the integrated intervention (IIG) for the remainder of the study; 12 weeks (Phase II) of IIG of the total 20-weeks study intervention protocol. Note that the control group was really only a true control for the first 8 weeks of the study and then received a full 20-week integrated intervention. During Phase II, the recreation therapy intervention included activities such as biofeedback, leisure counseling, expressive arts, adventure recreation, and stress management and relaxation training along with the Biofeedback activity that was implemented during the Phase I of the study intervention. Final assessments were administered again at the end of the week 20 for the IIG group, EX only group and RT only group following exactly the same battery of assessments administered to all subjects at baseline and week 8. The CO group also had a final assessment; however this took place after a full intervention of 20 weeks of the integrated intervention.

Participants

Data from 70 breast cancer survivors who participated and completed the Get REAL & HEEL After Care Breast Cancer Program between 2006-2011 were used in this retrospective study. The recruitment process for the study was completely voluntary. The breast cancer survivors were referred to the Get REAL & HEEL After Care Breast Cancer Program by either their oncology or radiation physician; or they may have received information from their cancer center about the program. Upon showing interest, they were given contact information to get further details about how to get involved. Over the phone, the program coordinator conducted an eligibility screening to make sure they fit the inclusion criteria. After receiving a consent form from the prospective patient's oncologist permitting

participation in the study, the initial intake appointment was scheduled. Prior to the initial intake visit, the breast cancer survivor received a packet containing the psychosocial questionnaires to have completed before the initial visit. The initial visit to the clinic consisted of an overview of the study protocol and the breast cancer survivors' medical history. During this visit, the participants signed informed consent, IRB and HIPPA authorization. This was followed by the randomization into one of four groups, which included: an integrated intervention group (IIG), exercise only intervention (EX), recreation therapy only intervention (RT), and a no intervention control (CO) group. Depending on which group the cancer survivor was placed, they were then given the pre-assessment guidelines and other baseline assessments.

All subjects were breast cancer survivors (Stages 0-III) who have completed their major cancer treatments (surgery, chemotherapy, radiation therapy or a combination of any of these treatments) with some women still undergoing hormonal therapy during their participation in the study. Inclusion criteria required individuals: who were within six-month post-treatment (they could still be on adjunct therapy), they had to have a diagnosis of early stage breast cancer, and be within the ages of 25-75 years old. Exclusion criteria entailed individuals diagnosed with: stage IV breast cancer, acute or chronic cardiopulmonary diseases, acute and chronic bone, joint, or muscular issues, immune deficiency [Absolute Neutrophil Count (ANC) < 1.5mL, Platelet (Plt) < 90 GL (900,000 mm^3), and/or Hematocrit (Hct) < 30%], renal function with creatinine < 1.5 mg/dL; or metastatic disease (the spread of disease from one organ to another) a common term recognized in cancer regarding 'metastasized cells'. Participants could also not participate in this study if they were a part of the "CanThrive" couples counseling research study.

Instrumentation

The following instruments were used for the assessment of psychosocial function: For the assessment of fatigue, Revised Piper Fatigue Scale was used (Piper, B.F. 1998). The Piper Fatigue Scale has four subscales each assessing a component of fatigue: affective, sensory, behavioral, and cognitive and mood scale. The score on these tests have a positive correlation between the average score and the level of fatigue (the higher the number score, the greater the fatigue). The Piper Fatigue Scale has a standardized Cronbach alpha of 0.97 and a subscale reliability range of 0.92-0.96 (Piper, B.F. 1998; Hsieh et al., 2008). The Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B) was used to assess the overall quality of life of breast cancer patients (Cella DF et al., 1993). This assessment tool includes 44 items and consists of the FACT-General (FACT-G) and the Breast Cancer Subscales (BCS). Studies using breast cancer patients have found this a good tool with test-retest reliability at an alpha level of 0.90 and subscale alpha coefficients ranging from .63-.86 (Brady, M. et al., 1997). The Center for Epidemiological Studies questionnaire (CES-D) was used for the evaluation of depression state of the breast cancer survivors. The CES-D is a 20-item questionnaire, commonly used to measure depressive symptoms in cancer patients. According to Hann, Winter and Jacobson the CES-D is a valid and reliable measure of depressive symptomatology in breast cancer patients (Hann, D.,Winter, K., and Jacobson, P., 1999; Jacobson, J.S., Workman, S. B., & Kronenberg, F. 2000). Scores for the CES-D range from 0-60, with 0 being no depressive symptoms and 60 being the greatest amount of depression (Boyd, JH, et al. 1982).

The following were the instruments used to assess physiological function through the exercise intervention portion of the study: blood pressure (BP) was assessed via Diagnostix

700 aneroid sphygmomanometer (Hauppauge, NY) and Litmann stethoscope (St. Paul, MN). Resting heart rate (RHR) was assessed via Pacer Polar heart rate monitor (Lake Success, NY), and pulse oximetry to determine hemoglobin saturation levels via Sport Stat finger pulse oxymeter (Plymouth, MN). Height and weight were measured using a balance beam physician scale with a height rod (Health-o-meter 402KL Rye, NY). Three-site skinfold measurements including: triceps, suprailium, and thigh were taken to determine body composition using a Lange C-130 Beta Technology calipers (Cambridge, MD). Body composition was analyzed with the ACSM female equations recommended (ACSM, 2006).

For the assessment of cardiorespiratory endurance, the modified Bruce submaximal treadmill protocol was used for the estimation of maximal oxygen consumption (VO_{2max}) using a calibrated Quinton Q65 treadmill, Fitness Equipment, Bothell, WA).

For the assessment of muscular fitness, standardized push-up and partial curl-up test (ACSM, 2006) and a sub-maximal testing protocol designed by the Rocky Mountain Cancer Rehabilitation Institute (RMCRI, Greeley, CO) using selectorized weight training equipment (Magnum Fitness Retro Series Machine, South Milwaukee, WI) machines and dumbbells (Power Systems Sports, Knoxville, TN). Biofeedback intervention was performed using emWave PC biofeedback software (HeartMath®, Boulder, CA) and the Healing Rhythms biofeedback system (Wild Divine, San Diego, CA).

Assessments

The Get REAL & HEEL study participants completed baseline battery assessments (physical and psychological) taken prior to the intervention, the same assessments were taken again after the first 8-weeks of intervention, and then final assessments were done at the conclusion of the 20-week intervention. A few assessments not listed, that were conducted

were: heart rate variability, heart rate coherence and cognitive assessments, balance, flexibility. However, since these were not of interest for this particular study they will not be described in detail.

Resting vital signs including heart rate, blood pressure and pulse oxymetry, were taken following a five-minute, quiet, seated rest period. If blood pressure was over 150/100 the breast cancer survivor was asked to sit and relax before continuing onto the next assessment. After resting the blood pressure was taken again and if normal ranges were attained the assessment would continue and if not, it would be delayed or postponed until another day. Once all vital signs were taken then the height, weight, body circumference measurements and body composition were taken of the breast cancer survivor.

For the assessment of cardiorespiratory endurance, a submaximal treadmill protocol (The Modified Bruce Protocol) was used for the estimation of maximal oxygen consumption (VO_{2max}). If a breast cancer survivor could not perform the treadmill test, the standardized YMCA cycle ergometer submaximal protocol was used to estimate VO_{2max} (Tosti et al., 2011). The Modified Bruce protocol is a widely used test for the assessment of cardiorespiratory function in clinical population. The Modified Bruce protocol has been described in detail previously (Lerman et al., 1976). The criteria for test termination included: 1) When participants reached 75% of their estimated maximum heart rate calculated using the Karvonen formula, 2) RPE reached 15 on the Borg perceived exertion scale, or 3) the participant requested to terminate the test before these previously mentioned criteria were reached. Once the cardiorespiratory endurance test was concluded the breast cancer survivor did a short cool down and stretching (5-10 minutes) while the estimated VO_{2max} was calculated and recorded.

The assessment of muscular fitness was administered after the conclusion of the cardiorespiratory endurance test. A standardized push-up and partial curl-up test and a sub-maximal testing protocol designed by the Rocky Mountain Cancer Rehabilitation Institute (RMCRI) using selectorized weight-training machines and dumbbells were used for the assessment of muscular fitness (Heyward, V., 2002). The amount of resistance used for each exercise was based upon a percentage of the patient's body weigh based following the RMCRI protocol (Schneider, C., Dennehy, & Carter, S., 2003). The bicep curls with dumbbells, lat pull-down, leg extension, leg curl were the exercises used to determine overall muscular endurance (OME) following the guidelines set by the RMCRI (Schneider, C., Dennehy, & Carter, S., 2003).

Interventions

Exercise Intervention

The exercise intervention followed the ACSM guidelines for elderly populations along with guidelines from Exercise and Cancer Recovery (Schneider et al., 2003). The exercise only group (EX) performed prescriptive individualized exercise intervention three times a week with an exercise specialist. Each session was about one hour long. All exercise sessions began with the assessment of resting vital signs to ensure subjects were not experiencing any abnormal condition that could endanger their participation in the exercise session. After the breast cancer survivor's resting vitals were deemed within the normal range, they started their exercise session with a cardiovascular exercise performed either on a cycle ergometer, elliptical, or treadmill. The mode of the cardiovascular exercise was chosen based on each breast cancer survivor's limitations and personal preference. A treadmill, however, was the main mode of exercise for the majority of the breast cancer survivors

throughout the study. Each cardiorespiratory exercise session lasted from approximately 10-30 minutes and with intensities between 40-65% of the estimated VO_{2max} attained during the baseline battery of assessments. To stimulate a training effect, the duration and intensity of the cardiovascular portion of the exercise intervention was increased whenever possible following guidelines set forth by ACSM. Breast cancer survivors would finish the study protocol performing 30 minutes of continuous cardiovascular exercise at intensities at 65% of estimated VO_{2max} attained during the week 8 assessment. Following the cardiovascular exercise, 20-30 minutes of resistance training (8-12 exercises targeting major muscle groups, 8-12 repetitions max, 1-3 sets, RPE of 3-7 on the modified Borg Scale), followed by 5-10 minutes of a cool down was administered to all breast cancer survivors. Resistance training exercises included a variety of machines, free weights, DYNA-bands, Pilates chair, medicine balls and/or stability (Swiss) ball. Exercises included: lateral and front shoulder raises, chest press, lat pull down, alternating bicep curls using dumbbells, triceps extension, leg press, leg extension, leg curl, standing calf raises and abdominal exercises (regular crunches, oblique crunches, and lower back). Exercises were progressed in workload and number of sets (1-2 or 3) as the breast cancer survivors became more highly trained and exceeded the baseline workloads. Each exercise was performed with full control performing a 3 second concentric and eccentric contraction. Rest was given between sets, consisting of thirty seconds to one minute. All progressions of exercise followed ACSM guidelines while also keeping account of each individual and their personal training responses.

Recreation Therapy Interventions

The recreation therapy intervention varied between Phase I (first 8 weeks) and Phase II (the 12 weeks following Phase I). For Phase I of the study (first 8 weeks), the RT group

and IIG group had a 30-minute biofeedback session 3 times a week. The recreation therapy group was specifically designed from the results of the psychological battery assessments. During the first week of the intervention, the recreation therapist would introduce the breast cancer survivors to the concept of the mind/body relationship. During the next two to four weeks, the survivor would be introduced to the four basic HeartMath techniques and biofeedback was used to see the heart rhythm response to the various techniques. Along with understanding the relationships between physical and mental functioning, the survivors also learned to discover their impact stressors while incorporating heart rate techniques (coherence) to deal with these stressors. The topics covered while in an RT session varied from person to person depending upon the issues each participant was facing. Some individuals worked on these techniques for 6-8 weeks, while others took up to 15 weeks. As the breast cancer survivor went through the various techniques the therapist would compliment the program software with the therapeutic needs of the individual.

During Phase II (12 weeks) all groups participated in the integrated intervention, which included an exercise intervention 60 minutes followed by 30 minutes of the total psychosocial therapy including biofeedback, 3 times a week. The recreation therapy intervention included various components including expressive arts, leisure counseling, the challenge course, biofeedback (HeartMath, Healing Rhythms, and Journey to the Wild Divine), stress management and relaxation training. The majority of the breast cancer survivors went through the healing rhythms, guided program for related topics they were dealing with. Once the participant completed the guided program they either would choose to review certain topics or they would transition into other areas of the program. As the program was individualized and focused to the needs of the participant, not all breast cancer

survivors received the same therapy at the same time. Some examples include but are not limited to: learning to write children's books by taking a class, find volunteer activities that match interests, learning to make jewelry, paint, play guitar, or picking up an old hobby that the participant has not done lately and would like to revisit.

Recreation therapy sessions were conducted correspondingly with the Leisure and Well-Being Model (Hood, C.D. & Carruthers, C., 2008). The Leisure and Well-Being Model exposes the individuals' weaknesses and negative experiences, while highlighting their strengths, capabilities, and positive experiences. The breast cancer survivors' resilience, wellbeing and quality of life can be determined with both the positive and negative variables considered. The model enriches ones psychological well being through the enhancement of leisure activities by developing resources and the capacity to engage in life long activities. The guiding principles of savoring, authentic leisure, virtuous leisure and leisure gratification all of which culminate in enhanced life experiences. Resource development is divided into five categories: psychological, social, cognitive, physical and environmental resources.

The types of recreation therapy and general procedures are described below for biofeedback (Heart Math, Healing Rhythms, and Journey to the Wild Divine), leisure counseling, expressive arts, adventure recreation (the challenge course), stress management and relaxation training. The administration of all recreation therapy interventions are conducted by or under the supervision of a certified/ licensed recreation therapist.

Biofeedback

Biofeedback is a method used by therapists to help breast cancer survivors understand awareness of how one's physical and emotional state impact physiological functions such as

heartbeat, blood pressure, and muscle tension along with psychological health (Chopra, & Ornish, 2008). HeartMath teaches the breast cancer survivors' heart-brain interactions and emotional physiology. The HeartMath program attempts to achieve the benefits of psychophysiological coherence in association with sustained positive emotions, mindfulness and harmony (Institute of Heart Math, 2009). Heart Math pursues psychophysiological coherence to aid in pain reduction and management, understanding of the interaction between controlled emotional experience, and its effect on heart rhythms and respiration (The Coherent Heart).The Healing Rhythms program monitors the patient's physical and emotional responses to stress through skin conductance and heart rate variability. The breast cancer survivor is given tasks to practice meditation and become more conscious of their body and thoughts (Wild Divine). The Journey to the Wild Divine training program combines meditation, slow, steady abdominal breathing, and connection to positive emotions in a three step process to achieve harmony in the subject's physiology (Wild Divine).

Leisure Counseling

Leisure counseling promotes increased awareness of the connection seen in leisure choices made by the breast cancer survivor's and the impact of attitudes, behaviors and values on their choices. The therapist helped the breast cancer survivor to discover their interests and hobbies during these sessions. The interventions used in leisure counseling came primarily from the following texts: Crossing the Bridge: A Journey in Self-Esteem, Relationships, and Life Balance (Negley, S., 1997), Games for Groups Vol. 1 & 2 (Cavert, C., 1999), Self-Esteem: Tools for Recovery (Hall, L. & Cohn, L., 1990), and Values Clarification (Simon, S., Howe, L., & Kirschenbaum, H., 1995).

Expressive Arts

Expressive arts give the breast cancer survivors a sense of freedom while stimulating the entire body senses, emotions, thoughts and feelings. In a typical session the therapist discussed the patient's goals while providing a physically and emotionally secure environment. Each technique was explained and the resources were gathered to supply a model of how to be open to the experiences.

Adventure Recreation

Adventure recreation presents risks through physically and/or mentally challenging tasks requiring the breast cancer survivors to cope with uncertainty. The confrontation with deliberate and controlled risk creates awareness of the breast cancer survivors' personal abilities, and how they relate to others and their environment surrounding. Research has demonstrated that adventure programs help to improve self-esteem, motivation, attitude, and internal locus of control (Cason & Gillis, 1994; Gillis & Gass, 2003). Little research has been done which explores the effect of adventure recreation on cancer survivors. Researchers and practitioners have theorized that adventure activities empower female cancer survivors to exceed personal and cultural perceptions of their abilities post cancer treatment (Groff, D. & Dattilo, J., 2000). Positive experiences with adventure recreation may result in improved physical self-perception, perceived competence, self-esteem, and attitudes towards risk. Each of these factors may increase the patients' optimistic attitudes toward their future (Seligman, M., 2006).

Activities such as the ropes course give the women a sense of power, choice, and control. All of which will help increase their will to survive when their lives feel powerless and monotonous. Breast cancer survivors engaged in one or two challenge courses. The low challenge course events facilitated social networks with other survivors using team building

and trust activities. The challenge course was located at the Outdoor Education Center on the campus of the University of North Carolina at Chapel Hill. The course facilitators were certified by the Challenge Course Program Coordinator and were trained and certified to run the Carolina Adventures challenge course located on the campus of UNC-CH.

Stress Management and Relaxation Training

The stress management and relaxation component of the psychosocial therapy incorporated various techniques including: deep breathing, progressive deep-muscle relaxation, coping skills training, visualization and cognitive reframing to decrease negative thoughts and control negative emotions. The therapist guided participants to respond in a healthier manner, gaining a brighter outlook on life.

The recreation therapy (RT) only group was prescribed biofeedback techniques using HeartMath®, Healing Rhythms and emWave PC, performed by a licensed recreational therapist. The program was guided by the five principles of the Leisure and Well-Being Model by Hoods and Carruthers including: savoring leisure, authentic leisure, leisure gratification, mindful leisure and virtuous leisure (Carruthers, C. & Hood, C., 2007).

Statistical Analysis

Data from the Get REAL & HEEL After Cancer Care Program study will be analyzed using SPSS 19.0. The probability level for the statistical significance will be set at an alpha level of ($p>0.05$).

H1. There will be significant positive changes in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life in the IIG group after the initial 8 weeks of the 20-week study intervention.

→H1 was analyzed using paired samples t-tests. To account for the multiple t-tests performed to test hypothesis 1, a Bonferroni adjustment was used. Therefore, the new alpha level used for the analyses of hypothesis was $p < 0.008$.

H2. There will be a significant difference in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes between the IIG group and the EX, RT, and CO groups during the first 8 weeks of the 20-week study protocol, with the IIG group experiencing the greater changes in all above mentioned physiological and psychosocial parameters.

→H2 was analyzed using 4X2 Mixed Model ANOVAs to analyze each outcome variable using delta scores (Week 8 measures – Baseline measures). Post hoc analyses were done using Scheffe.

H3. There will be significant differences in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes within each of the groups (IIG, EX, RT, and CO) from baseline to the completion of the 20-week intervention period in which all groups will receive the integrative exercise and psychosocial intervention (IIG).

→H3 was analyzed using 4X3 Mixed Model ANOVAs, using the results of the assessments performed at baseline, week 8, and final assessments for each study outcome variable. When an interaction effect was found to be significant, post hoc analyses using paired samples t-tests were used to examine where significant changes occurred.

H4. There will be no significant differences in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes between the groups (IIG,

EX, RT, and CO) from baseline to the completion of the 20-week intervention period in which all groups will receive the integrative exercise and psychosocial intervention (IIG).

→ H4 was analyzed using a 4X3 Mixed Model ANOVA using delta scores (Final assessment – Baseline assessment) for each group. When a significant interaction effect was found ($p < .050$), post hoc analyses using Scheffe were run to reveal where there were changes between groups.

CHAPTER IV

RESULTS

Participants

The purpose of this retrospective study was to examine whether an integrative exercise and recreation therapy intervention group (IIG) promotes positive changes on cardiorespiratory function, overall muscular fitness, body composition, fatigue, depression and quality of life in breast cancer survivors during the first eight weeks of a 20-week intervention. The secondary purpose compared the effects of the first eight weeks of the integrative exercise and recreation therapy intervention (IIG) to the first eight weeks of an exercise only intervention (EX group), recreation therapy only intervention (RT group), and a control, no intervention (CO group) on cardiorespiratory function, overall muscular fitness, body composition, fatigue, depression and quality of life in breast cancer survivors. After the first 8-weeks of the study intervention, breast cancer survivors in all groups received the integrative intervention (IIG) for the remainder of the study (12 weeks). Therefore, the tertiary purpose of the study examined changes over the course of the 20-week intervention on the aforementioned study outcomes cited above, in all groups from baseline. All data collected in this study was entered into an electronic database and analyzed using SPSS version 19.0 for Windows, a statistical software package. An alpha level of 0.05 was set for all statistical procedures, unless otherwise specified. The breast cancer survivors'

characteristics are presented in Table 1. Descriptive statistics are presented in the form of means and standard deviation.

Table 1: Survivors Characteristics

Characteristic	IIG (n=19) (Mean±SD)	EX (n=19) (Mean±SD)	RT (n=19) (Mean±SD)	CO (n=13) (Mean±SD)	P-Value
Age (yrs.)	49.9±9.1	54.9±8	51.8±8.7	52.3±13.6	.474
Weight (kg)	74.6±15.5	77.1±16.0	80.9±22.9	72.2±15.0	.488
Height (cm)	165.4±5.4	163.8±7.4	164.3±6.4	165.4±7.7	.851
RHR	81.8±13.2	73±12.3	78.1±12.1	74.6±8.4	.114
SBP	117.3±13.0	118.1±16.8	119.5±13.1	118.3±14.6	.974
DBP	77.2±9.7	74.7±10.8	75.2±10.7	76.4±7.8	.856
$SP0_2$	97.8±0.90	97.3±1.3	97.8±1.1	97.2±1.7	.426

** No significant differences for any characteristic of the survivors between groups were observed at baseline*

Descriptive statistics for all 4 groups for all outcome variables of the study measured 3 times throughout the study (Baseline, Week 8, and Final) is presented in Table 2.

Table 2: Descriptive Statistics of all 4 Groups at 3 different assessment time points

VARIABLE	GROUP	BASELINE (Mean±SD)	WEEK 8 (Mean±SD)	FINAL (Mean±SD)
VO_{2MAX} (ml O_2/kg/min)	IIG	28.9±6.4	33.1±7.8	33.8±6.7
	EX	31.1±8.1	34.1±8.2	36.6±7.1
	RT	31.9±8.4	32.4±6.9	36.3±6.2
	CO	32.5±7.6	33.3±7.2	39.6±5.5
OME (# of Repetitions)	IIG	54.7±18.5	102.4±35.7	124.5±40.4
	EX	51.5±24.1	90.5±33.6	114.6±41.7
	RT	54.8±29.9	58±31.0	107.9±48.3
	CO	62.9±26.7	62.6±27.5	118.9±35.1
% BF	IIG	31.3±8.1	29.8±5.5	27.7±4.9
	EX	29.6±4.0	28.7±4.8	28.6±4.7
	RT	30.6±5.3	31.1±5.3	28.3±4.4
	CO	27.9±4.5	28.3±5.2	27.6±4.4
FATIGUE (Scores)	IIG	4.6±2.0	2.6±1.9	1.8±1.7
	EX	5.3±2.4	3.4±2.3	2.8±2.2

	RT	4.5±1.6	2.9±2.3	2.5±2.1
	CO	3.8±1.6	3.4±1.7	3.1±1.6
DEPRESSION (Scores)	IIG	11.3±9.3	6.8±5.9	4.4±4.3
	EX	12.7±9.0	10.1±10.2	8.9±9.9
	RT	12.3±8.3	10.2±9.9	6.8±9.9
	CO	10.1±9.6	11.8±11.9	9.7±10.2
QOL (Scores)	IIG	103.7±22.5	117.2±14.4	121.9±17.4
	EX	103.3±21.4	112.1±16.6	116.5±16.4
	RT	108±19.3	114.6±20.0	117.8±22.3
	CO	107.1±15.8	110.7±14.8	117.2±16.0

Hypothesis 1

Hypothesis 1 stated that there would be significant positive changes in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life in the IIG group after the initial 8 weeks of the 20-week study intervention. Hypothesis one was analyzed using paired samples t-tests. To account for the multiple t-tests performed to test hypothesis 1, a Bonferroni adjustment was used. Therefore, the new alpha level used for the analyses of hypothesis one was $p< 0.008$. The results of the analyses revealed significant improvements from baseline to week 8 in VO_{2max} (28.9±6.4 and 33.1±7.8 respectively, p=.001), OME (54.7±18.5 and 102.4±35.7 respectively, p≤.0005), Fatigue (4.6±2.0 and 2.6±1.9 respectively, p≤.0005), and QOL (103.7±22.5 and 117.2±14.4 respectively, p= .001). No significant differences were found from baseline to 8 weeks for %BF (31.3±8.1 and 29.8±5.5 respectively, p= .246) or depression (11.3±9.3 and 6.8±5.9 respectively, p= .034).

Hypothesis 2

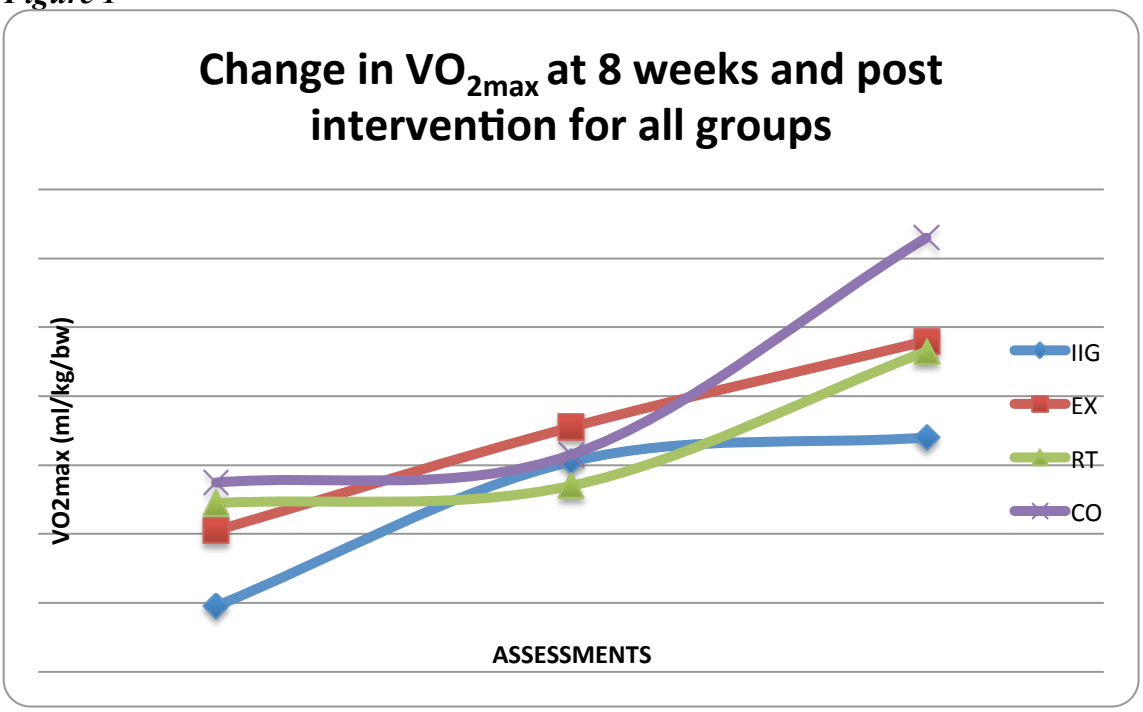
Hypothesis 2 stated there would be a significant difference in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes between the IIG group and the EX, RT, and CO groups during the first 8 weeks of the 20-week study protocol, with the IIG group experiencing the greater changes in all above mentioned physiological and psychosocial parameters. 4X2 Mixed Model ANOVAs were used to analyze each outcome variable, using delta scores (Week 8 measures – Baseline measures) for each variable analyzed. A significant interaction effect was found for OME ($p \leq .0005$). Post hoc analyses using Scheffe revealed significant differences between IIG vs. RT (47.6±24.3 and 3.2±16.3, respectively, $p \leq .0005$), between IIG vs. CO (47.6±24.3 and -0.79±11.5, respectively, $p \leq .0005$), between EX vs. RT (39±21.9 and 3.2±16.3, $p \leq .0005$) and EX vs. CO (39±21.9 and -0.79±11.5, respectively, $p \leq .0005$). No significant differences between groups were found for any other outcome variables.

Hypotheses 3

Hypothesis 3 stated there would be significant differences in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes within each of the groups (IIG, EX, RT, and CO) from baseline to the completion of the 20-week intervention. 4X3 Mixed Model ANOVAs, using the results of the assessments performed at baseline, week 8, and final assessments for each study outcome variable was used for the analyses of hypothesis 3. An interaction effect was found to be significant ($p \leq .0005$). Post hoc analyses using paired samples t-tests were used to examine where significant changes occurred.

Figure 1 depicts the changes in VO_{2max} for all groups from baseline to the completion of the 5-month study intervention. Note that after the week 8 assessment, all groups received a combination of exercise and recreation therapy.

Figure 1

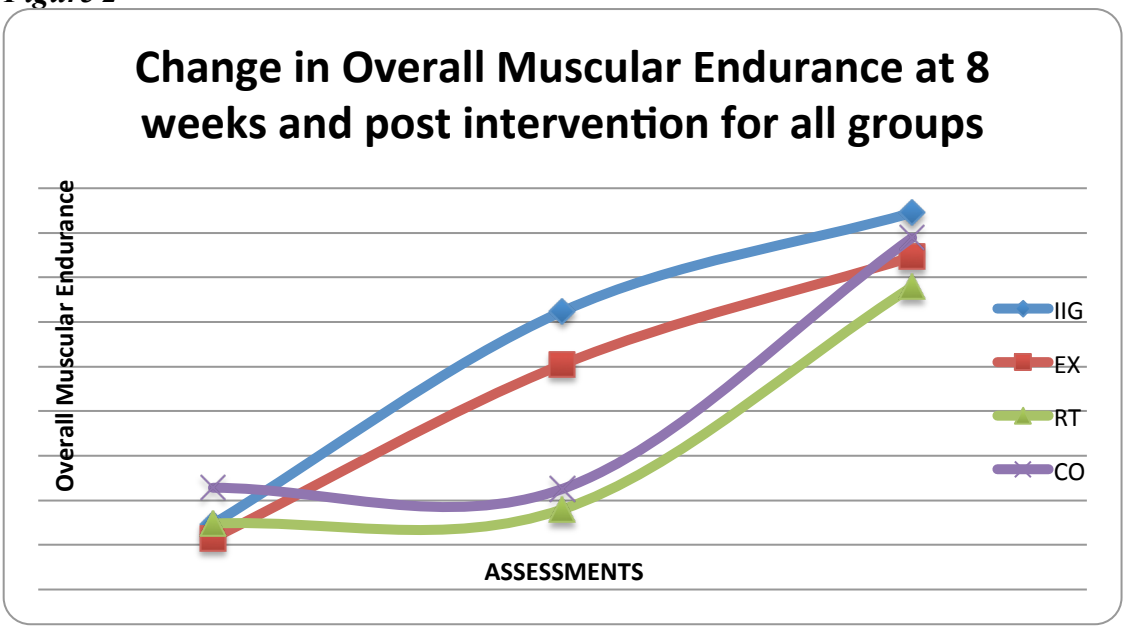


Significant improvements in VO_{2max} from baseline to week 8 were observed for IIG (28.9 ± 6.4 and 33.1 ± 7.8 respectively, p= .001), and EX (31.1 ± 8.1 and 34.1± 8.2 respectively, p= .030). Significant improvements in VO_{2max} from the week 8 assessment and final assessment were observed for EX only group (34.1 ± 8.2 and 36.6 ± 7.1 respectively, p= .030) and RT only group (32.4 ± 6.9 and 36.3 ±6.2 respectively, p≤.0005) and CO group (32.6 ± 7.2 and 38.4 ± 6.8 respectively p= .001). Finally, significant improvements were also observed from baseline to final assessment in VO_{2max} for IIG group (29.2 ± 6.4 and 33.9 ± 6.7 respectively, p≤.0005), EX only group (31.1 ± 8.2 and 36.6 ± 7.1 respectively, p= .002), RT only group (31.9 ± 8.4 and 36.3 ±6.2 respectively, p≤.0005) and CO group (32.5 ±7.6 and 39.6 ± 5.5 respectively, p≤.0005).

No significant differences in VO_{2max} from baseline to week 8 assessments were observed for RT group only (p= .657), and for CO group (p= .448); and from week 8 to final assessment for IIG (p= .274).

Figure 2 depicts the changes in OME for all groups from baseline to the completion of the 5-month study intervention. Note that after the week 8 assessment, all groups received a combination of exercise and recreation therapy.

Figure 2



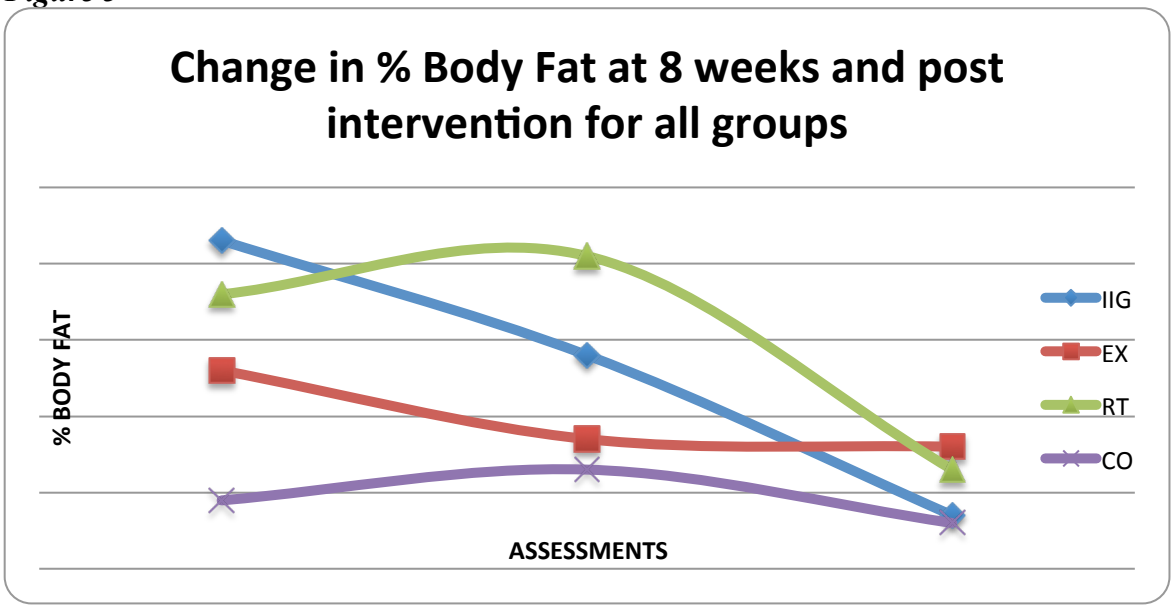
Significant improvements in OME from baseline to week 8 assessments were observed for IIG (54.7 ± 18.5 and 102.4 ± 35.7 respectively, p≤.0005), and EX (51.5 ± 24.2 and 90.5± 33.6 respectively, p≤.0005) only. Significant improvements in OME from the week 8 assessment and final assessment were observed for IIG (102.4 ± 35.7 and 124.5 ± 40.4 respectively p≤.0005), EX only group (90.5 ± 33.6 and 114.6 ± 41.7 respectively, p≤.0005) and RT only group (58 ± 31 and 107.9 ± 48.3 respectively, p≤.0005) and CO group (62.6 ± 27.5 and 118.9 ± 35.1 respectively p≤.0005). Finally, significant improvements were also observed from baseline to final assessment in OME for IIG (54.7 ± 18.5 and 124.5 ±

40.4 respectively, p≤.0005), EX only group (51.5 ± 24.2 and 114.6 ± 41.7 respectively, p≤.0005), RT only group (54.8 ± 29.9 and 107.9 ± 48.3 respectively, p≤.0005) and CO group (62.9 ± 26.7 and 118.9 ± 35.1 respectively, p≤.0005).

No significant differences in OME from baseline to week 8 assessment were observed for RT and CO groups, (p= .390 and p= .801 respectively).

Figure 3 depicts the changes in % BF for all groups from baseline to the completion of the 5-month study intervention. Note that after the week 8 assessment, all groups received a combination of exercise and recreation therapy.

Figure 3



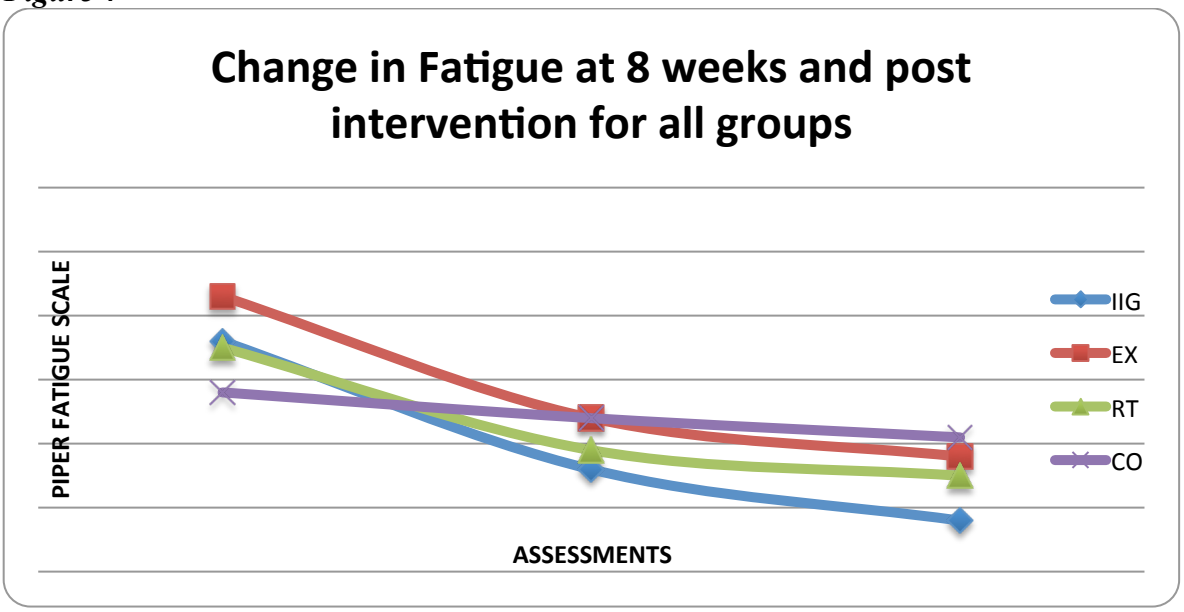
Significant decreases in % BF from baseline assessment to week 8 assessments were only observed for EX only group (29.6 ± 4.0 and 28.7 ± 4.8 respectively, p= .050). Significant decreases in % BF from the week 8 assessment and final assessment were observed for IIG (29.8 ± 5.5 and 27.7 ± 4.9 respectively p= .013) and RT only group (31.1 ± 5.3 and 28.3 ± 4.4 respectively, p= .001). Finally, significant decreases were also observed

from baseline to final assessment in % BF for IIG (31.3± 8.1 and 27.7 ± 4.9 respectively, p= .025), and RT only group (30.6 ± 5.3 and 28.3 ± 4.4 respectively, p= .003).

No significant differences in % BF from baseline to week 8 assessments were observed in IIG (p= .246), RT (p= .299), and CO (p= .181). No significant differences in % BF from week 8 to final assessment were observed for EX (p= .932) or CO (p= .383). Finally, no significant differences in % BF from baseline to final assessment were observed for EX (p= .225) and CO (p= .643).

Figure 4 depicts the changes in Fatigue for all groups from baseline to the completion of the 5-month study intervention. Note that after the week 8 assessment, all groups received a combination of exercise and recreation therapy.

Figure 4



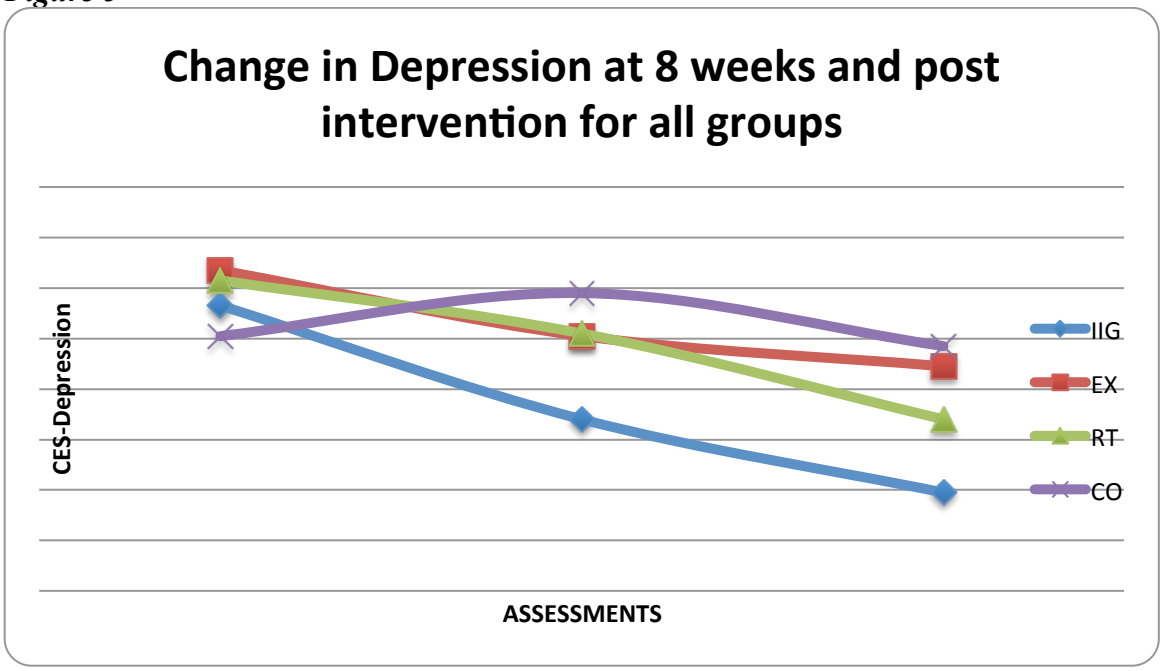
Significant decreases in fatigue from baseline assessment to week 8 assessments were observed for IIG (4.7 ± 2.0 and 2.7 ± 1.9 respectively, p≤.0005), EX only group (5.3 ± 1.9 and 3.4 ± 2.3 respectively, p= .002), and RT only group (4.3 ± 1.7 and 2.8 ± 2.2 respectively, p= .014). Significant decreases in fatigue from the baseline assessment and final assessment was observed for IIG (4.5 ± 2.1 and 1.7 ± 1.7 respectively p≤.0005), EX only group (5.0 ±

2.4 and 2.8 ± 2.2 respectively, p= .001), and RT only group (4.7 ± 1.6 and 2.7 ± 2.1 respectively, p≤.0005).

No significant differences in Fatigue were observed from baseline to week 8 assessments in CO (p= .222), from week 8 to final assessment in IIG (p= .166), EX (p= .306), RT (p= .235) and CO (p= .563) and from baseline to final assessment for CO (p= .233).

Figure 5 depicts the changes in depression for all groups from baseline to the completion of the 5-month study intervention. Note that after the week 8 assessment, all groups received a combination of exercise and recreation therapy.

Figure 5



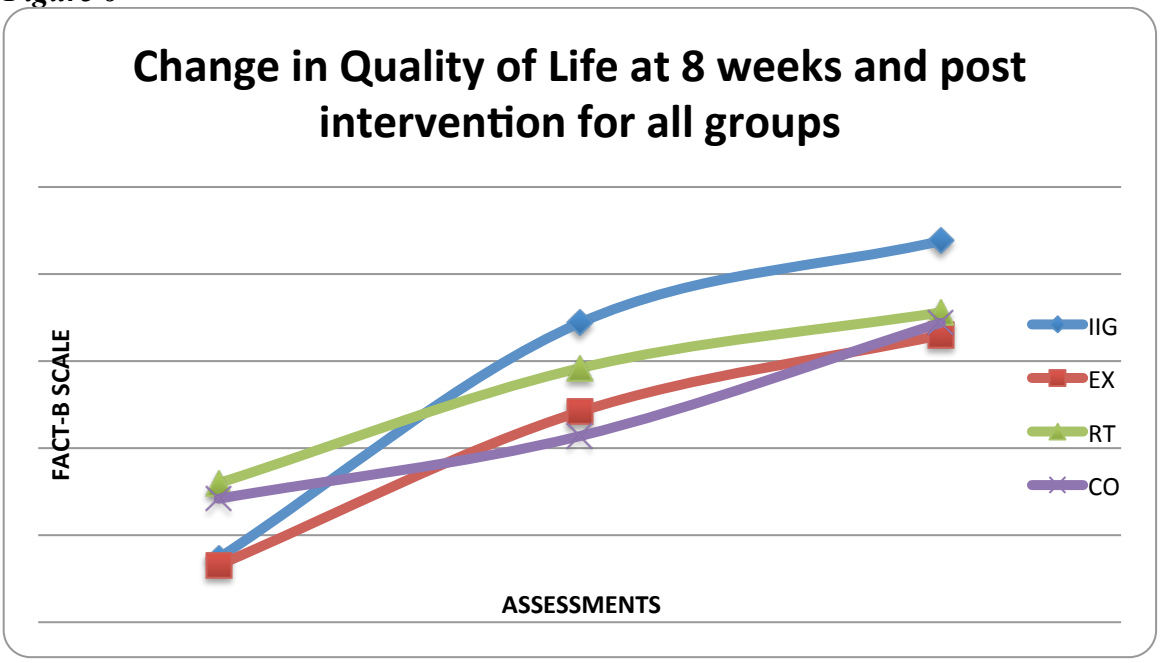
Significant decreases in depression from baseline assessment to week 8 assessments were observed for IIG (12.7 ± 9.3 and 7.3 ± 5.9 respectively, p= .034). A significant difference in depression from the week 8 to final assessment was observed for RT only group (10.2 ± 9.9 and 6.8 ± 9.9 respectively p= .041). Finally, significant decreases were also

observed from baseline to final assessment in depression for IIG (12.7 ± 9.3 and 4.4 ± 4.3 respectively, p≤.0005), and RT only group (12.3 ± 8.3 and 6.8 ± 9.9 respectively, p= .004).

No significant differences in depression were observed from baseline to week 8 assessment for RT (p= .109), CO (p= .708), and EX (p= .192), from week 8 to final for IIG (p= .064), EX (p= .488), and CO (p= .230), and from baseline to final assessment EX (p= .077) and CO (p= .388).

Figure 6 depicts the changes in Quality of Life for all groups from baseline to the completion of the 5-month study intervention. Note that after the week 8 assessment, all groups received a combination of exercise and recreation therapy.

Figure 6



Significant improvements in Quality of Life from baseline assessment to week 8 assessments were observed for IIG (103.7 ± 22.5 and 117.2 ± 14.4 respectively, p= .001), EX only group (103.3 ± 21.7 and 112.1 ± 16.6 respectively, p= .021), and RT only group (108.5 ± 18.9 and 115.3 ± 19.8 respectively, p= .012). A significant improvement in QOL from the week 8 assessments and final assessment were observed for CO group (110.7 ± 14.8 and

117.2 ± 16 respectively p= .039). Finally, significant improvements were also observed from baseline to final assessment in QOL for all groups, IIG (103.7 ± 22.5 and 121.9 ± 17.4 respectively, p= .001), EX only group (104 ± 21.4 and 117.1 ± 16.4 respectively, p= .001), RT only group (108 ± 19.3 and 117.8 ± 22.4 respectively, p= .021), and CO group (107.1 ± 15.8 and 117.2 ± 16 respectively, p= .011).

No significant differences in QOL from baseline to week 8 assessment were observed for CO (p= .205), and from week 8 to final assessment for IIG (p= .115), EX (p= .202), and RT (p= .272).

Hypothesis 4

Hypothesis 4 stated there would be no significant differences in cardiorespiratory function, muscular fitness, body composition, fatigue, depression and quality of life changes between the groups (IIG, EX, RT, and CO) from baseline to the completion of the 20-week intervention. A 4X3 Mixed Model ANOVA using delta scores (Final assessment – Baseline assessment) for each group was used for the analyses. A significant interaction effect was found to be significant (p= .050). Post hoc analyses using Scheffe revealed that the change in fatigue approached significance between IIG and CO groups (-2.8±2.3 and -0.49±3.1, respectively, p= .054) with the IIG group experience greater decreases in fatigue than the control group. No significant differences in changes between groups were observed for any other outcome variable included in the study.

Summary

The results of these analyses revealed that the IIG did promote positive changes in cardiorespiratory function, muscular fitness, fatigue, and quality of life within the first 8

weeks of a 20-week rehabilitation program in breast cancer survivors. However, no positive changes were found for body composition or depression in the IIG group.

The IIG and exercise only group (EX) each promoted greater positive changes in overall muscular endurance (OME) than the recreation therapy only and control groups.

Positive changes within groups were observed for multiple variables from baseline to final assessment. Significant differences were observed in VO_{2max} for IIG, EX, RT and CO. Significant differences were also observed in OME for IIG, EX, RT and CO. Positive changes were observed in body composition for IIG, and RT. Significant differences were found in fatigue for IIG, EX, and RT. Significant differences were also observed in depression for IIG, and RT. Finally, significant differences were also observed in QOL for all groups IIG, EX, RT, and CO.

Lastly, no significant change between any of the groups (IIG, EX, RT and CO) in any outcome variables from baseline to week 8 assessments and from week 8 assessment to final assessment was observed. Fatigue changes from baseline to final assessment approached significance between the IIG and CO groups, with fatigue demonstrating greater level changes (decrease in fatigue) in the IIG group when compared to the CO group. However, no other groups had significant change from baseline to final assessment in any of the other outcomes. Below is a table of the percent change found in each of the groups with all variables, from baseline to week 8 assessments, week 8 to final assessment, and baseline to final assessments. The asterisks indicate significant differences.

Table 3: Percent Change in all 4 groups throughout Intervention

VARIABLE	**GROUP**	**%Change Phase I** (Baseline to Week 8)	**%Change Phase II** (Week 8 to Final)	**%Change Overall** (Baseline to Final)
VO_{2MAX}	IIG	14.5*	2.1	17.0*

	EX	9.6*	7.3*	17.7*
	RT	1.6	12.0*	13.8*
	CO	2.5	18.9*	21.8*
OME	IIG	87.2*	21.6*	127.6*
	EX	75.7*	26.6*	122.5*
	RT	5.8	86.0*	96.9*
	CO	-0.5	89.9*	89.0*
% BF	IIG	-4.8	-7.0*	-11.5*
	EX	-3.0*	-0.3	-3.4
	RT	1.6	-9.0*	-7.5*
	CO	1.4	-2.5	-1.1
FATIGUE	IIG	-43.5*	-30.8	-60.9*
	EX	-35.8*	-17.6	-47.2*
	RT	-35.6*	-13.8	-44.4*
	CO	-10.5	-8.8	-18.4
DEPRESSION	IIG	-39.8*	-42.6	-65.5*
	EX	-20.5	-11.9	-29.9
	RT	-17.1	-33.3*	-44.7*
	CO	16.8	-17.8	-4.0
QOL	IIG	13.0*	4.0	17.6*
	EX	8.5*	3.9	12.8*
	RT	6.1*	2.8	9.1*
	CO	3.4	5.9*	9.4*

**Significant changes at P≤.05.*

Chapter V

Discussion, Conclusion, and Recommendations

Introduction

The purpose of this retrospective study was to examine whether an integrative exercise and recreation therapy intervention group (IIG) promotes positive changes on cardiorespiratory function, overall muscular fitness, body composition, fatigue, depression and quality of life in breast cancer survivors during the first eight weeks of a 20-week intervention. The secondary purpose compared the effects of the first eight weeks of the integrative exercise and recreation therapy intervention (IIG) to the first eight weeks of an exercise only intervention (EX group), recreation therapy only intervention (RT group), and a control, no intervention (CO group) on cardiorespiratory function, overall muscular fitness, body composition, fatigue, depression and quality of life in breast cancer survivors. After the first 8-weeks of the study intervention, breast cancer survivors in all groups received the integrative intervention (IIG) for the remainder of the study (12 weeks). Therefore, the tertiary purpose of the study examined changes over the course of the 20-week intervention on the aforementioned study outcomes cited above, in all groups from baseline.

Breast cancer is the second most common type of cancer, which accounts for nearly 28% of women being diagnosed in the United States (American Cancer Society, 2011). With advancements in medical treatments and early detection more women are surviving cancer

than ever before. With increased survival there is a great need for alternative methods to cope with the various side effects from the disease itself and the various treatments. Existing research has shown exercise useful in mitigating many physiological and psychological effects thus improving functionality and overall quality of life (Battaglini et al., 2007; Courneya et al., 2007; Courneya et al., 2008; Courneya et al., 2008; Dimeo, F., Stieglitz, R., & Novelli-Fischer, U. 1999; Galvao, D.A. & Newton, R. U. 2005). However, exercise alone may not address all the issues that arise with the ongoing survivorship. A combined intervention involving exercise and recreation therapy may be of greater benefit providing therapy to address the body as a single unit of mind and body, thus improving both the physiological and psychological difficulties that cancer survivors face on a daily basis.

The goal of the physical aspect of an integrated program is to promoter positive cardiovascular function and overall muscular endurance making activities of daily living less taxing and providing a sense of autonomy and greater functionality, while also improving body composition to improve self-esteem and decrease the risk of recurring disease; all factors that have the potential to improve overall quality of life while perhaps promoting longer survival. The recreation therapy component is designed to assist survivors as they face deeper emotional and psychological issues including a loss of identity and self-esteem, reduced ability to focus and chronic stress stemming from a fear of recurrence or even death. By using this integrated intervention approach there is a greater ability to address the body as a whole and create a lasting impact to improve the lives of cancer survivors.

The effects of an integrative exercise and recreation therapy intervention on breast cancer survivors on selected physical and psychological parameters

The results of the analyses on this project revealed significant improvements in the integrated exercise and recreation therapy group (IIG) from baseline to week 8 of the study intervention in VO_{2max}, OME, Fatigue, and QOL. No significant differences were found from baseline to 8 weeks for % BF or depression. Although there are few studies that have used some sort of a combined intervention (Courneya et al. 2003; Kim & Kim, 2003) there have been a lot more studies conducted using exercise interventions with breast cancer populations.

The significant improvements in VO_{2max} after participation in 8 weeks of integrated exercise and recreation therapy were evident with a mean increase of roughly 14.2%, an average of 4.2 ml O_2/kg/min. This average was consistent with previous literature (Battaglini, 2004; Courneya, et al, 2003, Crowley, 2003; MacVicar, Winningham, & Nickel, 1989; Kolden et al., 2002; Adamsen et al., 2003; Hsieh et al., 2008). A meta-analysis performed by McNeely, et al. showed an average improvement of 3.39 mL/kg/min, almost one metabolic equivalent (MET) improvement. Courneya et al, observed a 17.4% increase in peak oxygen consumption after a supervised exercise training intervention progressively increasing 15-35 minutes per exercise session. MacVicar et al found a 15 and 23% increase in VO_{2peak} with an interval cycling progressive program at 60-85% of HR max, 3 times/week for 10 weeks.

Although the VO_{2max} was significantly different it did not improve tremendously. The reason for this may be as previous research has shown that 2 months is not always sufficient for great improvements in oxygen consumption. Plus the baseline measures for this particular group was fairly high to start for a breast cancer population and therefore the improvements would be less evident. The pre-intervention mean predicted VO_{2max} in this

study was 28.9 mL/kg/min, when compared to Hsieh et al's mean baseline oxygen consumption of 20-21 mL/kg/min. Existing research also showed the potential for submaximal treadmill tests to overestimate VO_{2max} in women, which could explain some of the discrepancy (Hartung, Blancq, Lally, & Krock, 1995). There could also be some variance due to the fact that a variety of protocols are used to determine oxygen consumption. One particular study done by Dimeo, for example, used a cycle ergometer rather than a graded treadmill test (Dimeo et al., 2004). These changes physiologically are most likely due to neuromuscular adaptations rather than biochemical/metabolic changes due to the short training period of 8 weeks. Nevertheless, the improvement was greater than 1 metabolic equivalent (MET). Research has shown that improvement in oxygen consumption of that magnitude may potentially play a role on preventing cancer re-occurrence (Holmes at al., 2005). Another explanation for the change in VO_{2max} could be due to the test-retest improvements. Since the survivors were already accustomed to the test and they were familiar with the protocol that could allow them to relax more, since they knew what to expect. Since the test was heart rate based a lower starting heart rate would show an improvement from the initial test.

In order to measure overall muscular endurance the Rocky Mountain Cancer Rehabilitation Institute submaximal muscular strength protocol and the modified push-up and partial curl-up standardized protocols were performed. Breast cancer survivors in this study also had significant improvements in overall muscular endurance of about 87.5%, roughly 54.7 repetitions. Studies using cardiovascular and resistance training such as that done by Milne, et al in 2008 showed both physical and psychological benefits and overall improvements of fatigue and other quality of life outcomes. A study done by Schneider et al

looked at muscular endurance broken up into upper body, lower body and core endurance and found significant improvements in all outcomes, along with decreases in psychological outcomes such as fatigue and quality of life (Schneider et al, 2007). The improvements observed in Schneider study were similar to those found in this study with improved upper-body muscular endurance (+79.1%) and lower-body muscular endurance (+49.7%), however this was after 6 months of exercise training, for 60 minutes, 2-3x/week, and included both breast and prostate cancer survivors. Again, results are similar to that of the literature but protocols vary throughout making it hard to do a close comparison. In this particular study, the population being breast cancer survivors, there are restrictions on the intensity of the resistance training. Early adaptations that occurred are most likely due to the neuromuscular improvement, with restricted increases in muscle size (hypertrophy of the muscle), since during the first 4-6 weeks, loads were low and the primary focus was to develop proper technique and form as to prevent injury. Some neural adaptations that may occur include improved motor unit synchronization, increased central nervous system activity (Brooks et al., 2005, McArdle et al., 2001).

Improving cardiorespiratory endurance and muscular fitness is important to the overall well-being and quality of life for these breast cancer survivors. By improving these physiological parameters, activities of daily living become more manageable thus improving overall functionality. By improving overall functionality, fatigue may decrease and the overall quality of life may improve. In this study, the integrated intervention group showed significant improvements in fatigue and quality of life within the first 8 weeks of the study.

Fatigue is a symptom that is very common among breast cancer patients and survivors with 72% to 95% of all cancer patients or survivors experiencing fatigue to some

degree (ACS, 2011). About 30% of cancer survivors' report that the impairment of physical functioning that occurs as a result of their fatigue persists for years after the conclusion of treatments (Dimeo et al., 2000). Cancer-related fatigue affects an individual both physically and psychologically. Fatigue may be enhanced due to the various anti-cancer treatments that come with a plethora of side effects such as lack of energy, insomnia, nausea and vomiting, endocrine changes, loss of appetite, and stress, to name a few (Battaglini et al., 2006; Galvao & Newton, 2005; Winningham, 1991; Dimeo et al., 2004).

Significant decreases in fatigue were observed among the IIG group after participating in a combined exercise and recreation therapy intervention program. Exercise helps to reduce fatigue by stimulating red blood cell production, improving removal of toxins, and enhances energy production (Battaglini et al., 2006). The improvements in physical performance that accompany an exercise training program, such as the one used in this study, may lead to the decreases in fatigue (Dimeo et al., 2004). Recreation therapy with a focus on emotional well being, stress management, and coping skills has also been shown to help reduce fatigue by addressing the psychological factors associated with survivorship (Pinto, 2005; McNelley et al., 2006). By reducing stress, fear, and anxiety, and improving ones ability to cope with such feelings, overall mood may improve helping to decrease fatigue as seen in many similar studies (Adamsen et al., 2004; Dimeo et al., 2004; Battaglini et al., 2006; Hsieh et al., 2008).

In this study fatigue was improved by 57%. Fatigue scores using the Revised Piper Fatigue Scale were similar to scores recorded in the study done by Hsieh, et al., (2008) however their sample started with slightly higher baseline fatigue and the intervention period was much longer than this particular sample and the improvement was about 39% (Hsieh, et

al., 2008). The large improvements seen in this study in only eight weeks of combined intervention compared to Hsieh's 6 month exercise only intervention may be due to the combined effect. An 8 week intervention study, which involved a mixed-type exercise program at a moderate intensity, improved mean fatigue scores from 4.9 to 3.8 in a study by Turner, Hayes, and Reul-Hirche (2004), which is less than this study; however, the frequency of Turner's intervention was only once per week while these study participants had three sessions per week. An integrated intervention study by Kim & Kim involving an exercise and relaxation breathing in a sample of stem cell transplant patients, showed a 52% reduction in fatigue. The mean baseline fatigue was 6.1 and was reduced to 2.9. The level of improvement of fatigue scores in the Kim study was very similar to those of this study suggesting a great benefit in the reduction of fatigue and fatigue like symptoms from an integrated approach. The aforementioned studies reveal that the benefits in the reduction of fatigue scores are greater in those studies that had a combined intervention approach than those with an exercise only intervention.

Quality of life was another variable that demonstrated significant improvements in the integrated exercise and recreation therapy group. Quality of life in this study was assessed using the FACT-B questionnaire. Previous studies have found improvements in quality of life with exercise interventions and psychological interventions but again, as with the other variables not many explore a combined intervention. Since variables such as mood, income, and fatigue are significant predictors of QOL (Suh, 2007), the improvements in this study may tell of how a combined therapy may help to improve overall mood and symptoms of fatigue thus improving overall quality of life. A study on reliability and validity of FACT-B found an average total score of 111.8 and 112.8 among a group of 47 and 295

breast cancer patients, respectively.

A study done by Courneya et al, (2003) which most resembles this study was done to determine if a combined exercise and psychotherapy intervention could improve quality of life in breast cancer survivors greater than psychotherapy alone. In this study were cancer survivors divided into two groups (psychotherapy and home-based exercise) and the results suggest that a combined therapy may improve QOL to a greater extent than psychotherapy only with a 5% improvement (Courneya et al., 2003).

Comparing the effects of different interventions on selected outcomes during the first 8-weeks of the program

In this study the only differences between changes in groups in the first 8 weeks were in overall muscular endurance. Muscular endurance is very important in functionality of daily life. With a loss of strength, one can lose the ability to do simple tasks making activities of daily living more difficult or even impossible. The differences in changes for OME were found between the IIG (+87% change) and the RT only group (+5.8% change) and the IIG (+87% change) and control groups (-0.5% change). A difference in changes was also revealed between the EX only group (+75.5% change) and the RT only (+5.8% change) and between the EX only group (+75.5% change) and CO (-0.5% change). This aligns with previous literature that conducted similar exercise interventions that resulted in muscular fitness improvements (Schneider et al, 2007; Milne et al, 2008; MacVicar, Winningham, and Nickel, 1989). Courneya et al, found that muscular fitness is not only important for physical tasks but has been linked with improved quality of life (Courneya et al, 2007). A 12 week, randomized controlled trial by Milne et al examined the effects of combined aerobic and resistance exercise on quality of life outcomes in two groups (immediate exercise and

delayed exercise group). Milne et al found that by increasing strength, confidence was increased along with a decline in physique anxiety scores (Milne et al, 2008).

There were no significant differences between groups in VO_{2max}, body composition, fatigue, depression or quality of life. Although the CO and RT groups were asked to maintain normal activities and not participate in any systematic exercise, they could not be forced to follow directions. For that reason if they were excited about changing habits they could have began their own exercise program or started walking, etc. A significant difference between groups was not observed in body composition possibly due to the fact that many women in the study were undergoing hormonal therapy which has been correlated with weight gain (Garreau et al., 2006). Although a trend of decreasing body fat was observed on the IIG (-1.4) and EX (-.86) groups while RT (+2.1) and CO (+ 0.56) were increasing. These changes, which occurred in eight weeks, could be due to the body composition method analyses. Even though the study was set up to attempt to control for anything that can cause variation in the testing, it is difficult to control all possible confounders that can cause slight variations in all measurements.

Although a lack in significant changes between groups was revealed for fatigue, depression and quality of life, all variables showed positive trends for improvement for the IIG, EX only and RT only groups. In the CO group there was very little change or even a slight decrease in the above outcome variables.

Physiological and psychological changes within/between groups throughout the 5-month intervention

Throughout the 5-month intervention, positive changes were observed for all variables. This was to be expected when looking over the course of the study as every group

eventually receives the integrated exercise and recreation therapy intervention (IIG). Significant differences were observed in cardiorespiratory function (VO_{2max}), muscular fitness (OME) and quality of life (QOL) in all groups. This is consistent with the literature as both exercise only and a combined intervention (involving both physical and psychological therapy) has shown to have a positive impact on physiological adaptations in this case (VO_{2max} and OME) as well as enhancing the overall QOL of those individuals participating in such programs (Courneya et al, 2003; McKenzie et al, 2003; Neiman et al, 1995; Segal et al, 2001; Schmitz et al, 2005; Campbell et al, 2005). By improving health and functionality these survivors may feel a sense of accomplishment, they will be able to do activities of daily living with ease and therefore their quality of life may in response, be improved.

Negative changes in body composition are often associated with negative health outcomes. For breast cancer survivors specifically, the increase in adiposity could increase the risk of recurrence by exposing estrogen dependent tumors from the increase estrogen release from fat cells. In this study, the only differences within groups for %BF were found within IIG and RT. A possible reason for these significant differences seen in the IIG and RT groups could be due to the fact that both groups were receiving recreation therapy for the full intervention. As the recreation therapy has a large focus on stress management and heart rate coherence techniques these two groups could have improved their stress management techniques, thus reducing stress. In managing stress and sustaining heart rate coherence there has been association with improved (DHEA) / cortisol ratios, which have been related to reduced stress reactivity and improved homeostasis (McCraty, 2003; McCraty & Childre, 2002). By improving and maintaining homeostasis the body will be more efficient during exercise thus seeing greater improvements in body composition. Another possible

explanation for not all groups seeing significant differences could be that the majority of participants in this study were older women (average age: 52.2 ± 9.9 years). Research has shown that women who are older generally have more visceral fat than subcutaneous, which may make it more difficult to determine body composition changes using skinfold measurement (Zamboni et al., 1997). Another factor impacted by body composition is quality of life and depression (Courneya et al, 2007). The results found in this study revealed a significant improvement in body composition, quality of life and depression scores in both the RT and IIG groups; thus revealing that improved body composition may in fact impact quality of life and depression in breast cancer survivors.

As hypothesized, this study revealed no significant differences between groups over the 5-month intervention. From this information, it could be extrapolated that regardless of the 2-month delay in the control group, they were still able to essentially "catch up" to the other groups after taking part in the combined intervention. Being that the no intervention CO group was able to catch up after having a delayed start to their intervention, this can help to explain the reason for the lack of difference between the groups for the entire intervention, since all groups did receive the same intervention for the second phase of the study.

As mentioned earlier in chapter V, previous research has recognized there being a need for an integrated program that helps to address some of the deeper struggles that breast cancer survivors are forced to face daily (Battaglini et al., 2006). To ignore these issues and say statistically it may not be necessary and go on without it is neglect. As this study is individualized for both the exercise prescription and recreation therapy it is meant to meet the needs of each individual, a qualitative study may have more promising results (McGhee & Skalko, 2001).

Another observation made from this study was that the control, no intervention group showed slight improvements in a few of the outcome variables during the (usual care) control period (8 weeks). The question begs how might this happen when no course of action is taking place? It would make sense that the psychological variables may improve due to the anticipation of starting the program. Knowing that there is something to look forward to in the near future may help to improve quality of life and decrease depression. An explanation for the physiological improvements could be that although this group was not supposed to partake in any systematic exercise there is no real way to control this. There is a possibility that knowing they will be starting an exercise program soon, they want to get a jump start on it and begin walking more or becoming more active in general.

As for the general timeline of the intervention, 5 months seems to be more than sufficient time period to see both physiological and psychological improvements. As the results showed, significant improvements in many physiological and psychological parameters were observed early on during the first 8 weeks of the study for patients enrolled in specific intervention groups. Table 3 shows the percent change between the two phases of the intervention.

As seen in table 4 some improvements will occur more rapidly (quality of life, fatigue, depression, muscular endurance) while others may take more time (VO_{2max}, body composition, and anxiety or fear of recurrence could even last forever). The full 5-month intervention has obviously shown a greater improvement in all variables than the first 8 weeks (2 months). This is important to help breast cancer survivors understand the importance of retention, and maintaining these healthy lifestyle adjustments. The greatest

percent change in most variables occurs in the first 8 weeks of intervention and from there (the following 12 weeks, 3 months) it continues to increase just not to the same degree.

Conclusions

Overall, a combined intervention involving exercise and some form of psychosocial intervention seems to promote improvements in both the physiological and psychological parameters discussed. As we observed with the results of this study, it does not seem that differences between the IIG and EX groups are large enough to distinguish potential differences between the benefits that these groups have provided to the survivors. Although in the first 8 weeks of intervention the changes in all variables were slightly greater in the IIG than EX only they still were not significantly different between these two groups. One cannot explain at this time if an additive effect to exercise only by incorporating RT is actually occurring.

However, many psychological effects from cancer and cancer treatment such as stress, uncertainty about the future, ability to improve their concentration skills and being able to re-organize life priorities, which are extremely helpful to cancer patients to regain their true overall health may not be attained by only exercising. The next step in research would be to continue to explore the combined intervention effect and move on to exploring the cost-benefit and perhaps define strategies to improve the way we prescribe the intervention to different patients. Some may need only exercise while others only recreation therapy or the integrative intervention.

Recommendations for Future Research

The following are recommendations for future research in the exploration of integrated interventions for breast cancer survivors.

1. Classify subjects by stages of cancer and treatments received and see if this has an impact on the various interventions.
2. Develop standard protocols for recreation therapy intervention to make it reproducible for research purposes, which might be difficult since the individualization of treatments is part of the RT intervention process. However, with standardization it might be easier to examine the stages of improvement achieved in therapy sessions to determine if rate of progression has been achieved and it is due to the intervention process independently of exercise.
3. Include a healthy control group to determine if the responses would be the same as those found in the breast cancer population.
4. Include an at-home exercise intervention group to see if the responses are similar to those receiving an intervention using specialized trainers. If outcomes are similar this could enhance cost effectiveness.
5. Measure body composition using the Dual Energy X-ray Absorptiometry (DEXA), to eliminate technician error that may occur for skinfold measurement. The DEXA accounts for variability within the measurement making comparisons between time points more precise.
6. Include males with breast cancer to determine gender differences in responses and make the sample more generalizable.

7. Add a 16 week assessment to the EX only, RT only and IIG groups or a 20 week assessment to the CO to determine whether there is a true catch up that occurs in the control group over time.
8. Perhaps the use of a VO_{2peak} test with the goal of maximizing the precision not only of the measurement of cardiorespiratory function, but also the quality of the exercise prescription should be explored.

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