IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 8, Issue 1 Ser. X. (Jan. - Feb .2019), PP 55-60
www.iosrjournals.org

Aerobic Versus Resistive Training on Cardiorespiratory Fitness in Patients with Cancer Related Fatigue: A Randomized Controlled Trial

Aisha A Hagag[(1)], Eman Y Salem[(2)], Mohamed K Seyam[(3)]
[1]*Department of Physical Therapy For Cardiovascular/Respiratory Disorders and Geriatrics, Faculty of Physical Therapy, Cairo University, Egypt.*
[2]*Department of Fitness and Rehabilitation Unit, Cairo University Hospitals, Egypt.*
[3] *Department of physical therapy, Zagazig University Hospital, Egypt*
Corresponding author: Aisha A Hagag

Abstract: *The purpose of this study was to compare the effect of aerobic and resistance training program on the cardiorespiratory fitness and quality of life (QOL) in breast cancer survivors. Fourteen women were randomly assigned into two groups who were equal in numbers: aerobic (AET) and resistance training (RET) groups. AET consisted of electronic treadmill walking , 3 times per week for twelve weeks. RET involved nine different exercises; leg extension, leg curl, calf raises, seated row, triceps extension, biceps curls, modified curl-ups, low back extension, and lateral pull-down. Before and after the intervention period, all of the women performed six minute walk test to measure their functional capacity. Quality of life was assessed using multidimentional fatigue inventory (MFI-**20)**. Results showed that distance walked and vo2 max increased significantly in both groups in favor of AET group . MFI-20 decreased significantly in both groups in favor of AET ($p \leq 0.05$). we concluded that aerobic or resistive exercise programs are enough to sufficiently relieve cancer-related fatigue and restore physical fitness and activity levels in breast cancer survivors, However aerobic program is much better.*

Key words; *aerobic , resistance, cardiorespiratory fitness, cancer related fatigue*

Date of Submission: 13-02-2019 Date of acceptance: 28-02-2019

I. Introduction

Cancer-related fatigue is a common problem for people with cancer. Approximately 80 to 100% of people with cancer report that they experience cancer-related fatigue. Furthermore, many people continue to experience fatigue for months or years after successful treatment. (1)

The National Comprehensive Cancer Network, 2013(2) defined cancer-related fatigue as 'a distressing, persistent, subjective sense of physical, emotional and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning'. Cancer-related fatigue also has a severe impact on daily activities, social relationships, reintegration and overall quality of life.(3)

Physical activity has been proposed as an effective nonpharmacologic intervention to promote psychological wellbeing during and following cancer treatment. (4) A recent Cochrane systematic review about exercise and cancer-related fatigue concluded that aerobic exercise reduces cancer-related fatigue and encouraged further research of other exercise modalities.(5)

Previous research has assessed the effects of cardiorespiratory exercise training engaging large muscle groups (treadmill or outdoor walking, leg pedalling exercise) on the physical work capacity and tolerance to physical fatigue of cancer patients and survivors.(6) Results from these studies consistently show a significant improvement in functional capacity after training.

Considerably less research has been conducted on the effects of resistance training on the physical work capacity of cancer patients or survivors. Resistance exercise should, however, be an integral component of any exercise training program, as it attenuates the muscle atrophy induced by both treatment and sedentary living habits in cancer survivors and also contributes to improved overall physical capacity . (7)

Lin et al., (8) compared the effects of a supervised exercise intervention with those of usual care for 12 weeks in colorectal cancer patients during chemotherapy, and found significant improvements in the supervised exercise group on fatigue, physical activity, physical functioning, social functioning, hand-grip strength, cardiorespiratory fitness, and pain subscales of quality of life. Similarly, in a sample of 113 breast cancer

patients, Schneider et al. (9) reported that moderate-intensity individualized exercise improved cardiopulmonary function and fatigue during and after treatment.

The current study is an attempt to compare the effect of aerobic versus resistance training in improving cardioresoiratory fitness and quality of life in breast cancer survivors.

II. Subjects Ad Methods

Subjects : a randomized controlled comparative study included 40 breast cancer survivors. Before the study an informed consent was obtained from each participant and the study was approved by the local Human Investigations Committee. A preliminary screening for subject selection was performed in the medical database of the Oncology Department of kasr Al Ainy hospital, Cairo university. After the corresponding oncologist provided consent, subjects were considered eligible for the study if they met each of the following conditions: premenopausal women surviving breast cancer (stageI-II ductal carcinoma); age range: 35-45 years, BMI 25-34.9kg/m^2; previous anti-cancer treatment consisting of surgery with lumpectomy and both post-surgery radiotherapy and chemotherapy; they were recruited to participate in the study two weeks after completion of their treatment. Women were excluded from the study if they had cardiac disease, diabetes mellitus, hypertension (blood pressure > 150/90 mm Hg), uncontrolled pain, , severe anaemia (Hb< 8 g/dL); fatigue related to other conditions (i.e. autoimmune disease, chronic renal failure); neurologic or muscular impairment precluding participation in an exercise program, skeletal metastases resulting in bone instability, or progressive disease with indication of new or additional therapy. Women with lymphedema were also excluded.

Subjects were randomly assigned into two groups that were equal in numbers; aerobic training group (AET) and resistance training group (RET)

III. Testing Procedures

6-Minute Walk Test (6-MWT). Physical fitness was assessed by the 6-MWT which measures how far the patient can quickly walk on a flat, hard surface during a 6-minute time period. It assesses the patient's functional capacity on a sub-maximal level and reflects the exercise level for daily physical activities. A healthy individual's 6-MWT range from 400 to 700 meters (m), and an improvement of more than 70m is considered to be of clinical importance to the patient. (10)

Using the Cahalin formula [VO2max = 0.006 × 6MWD(feet) + 3.38](11)

The 6MWT was carried out using a 30-m straight walk course marked out on the flat surface of the medical gymnasium, with chair placed at both ends of the course. Women were instructed to stand at the zero mark of the walk course, and then walk at her own pace, to cover as much ground as possible in a period of 6 minutes. Timing with a stopwatch began when the woman was instructed to "go" and ended when the stopwatch read 6 minutes. Every minute, woman was encouraged with standardized statements "You are doing well". They were allowed to stop and rest during the test when tired, but were instructed to resume walking as soon as they were able to do so. The total walking distance covered during this period was measured and recorded in meters. (12)

Multidimensional Fatigue Inventory MFI-20

The MFI-20 comprises five subscales: general fatigue, physical fatigue, mental fatigue, reduced activity, and reduced motivation. Each subscale includes four items with five-point scales. General fatigue includes general statements about fatigue and decreased functioning and was designed to encompass both physical and psychological aspects of fatigue. Physical fatigue concerns physical sensations related to fatigue. Mental fatigue pertains to cognitive functioning, including difficulty concentrating. Reduced activity refers to the influence of physical and psychological factors on the level of activity. Reduced motivation relates to lack of motivation for starting any activity. Scores on each subscale range from 4 to 20, with higher scores indicating greater fatigue**.** (13) The MFI is a self-report, pencil and- paper measure requiring between 5 and 10 min for completion.(14)

The aerobic training program

The aerobic treadmill-based training program was started with a 5-minute warm-up phase performed on the treadmill (YY>9028D made in china with input voltage AC220-240 v/50-60 HZ) at a low load, Active phase of the training session was gradually increased from 20 to 40 minutes in the form of walking on electronic treadmill with zero inclination three times per week for twelve weeks, The intensity of exercise session was determined by using karvonen equation(training heart rate =[% (maximum heart rate- resting heart rate)] + resting heart rate) the intensity was gradually increased from 60% to 70%. The peak heart rate is the maximum heart rate obtained as 220-age. This rate was defined as the training heart rate (THR).(15) Training heart rate was measured using pulsometer watch and treadmill speed ranged from 2 to 5 kilometer per hour throughout the session. Patients were instructed to categorize the walking intensity in four different intensity levels (light,

moderate, vigorous, and very vigorous according to borg scale.(16) They were encouraged to obtain moderate intensity during walks. At the end cool down for 5 minutes through low speed walking . Training sessions were performed in a hospital-based setting and supervised by personal trainers with specialist degree in physical therapy at fitness and rehabilitation centre at Kasr Al Ainy teaching hospital..

Resistance training

Participants were asked to exercise three times per week performing two sets of eight to twelve repetitions of nine different exercises at 60% to 70% of their estimated one repetition maximum.(17) The exercises were leg extension, leg curl, calf raises, seated row, triceps extension, biceps curls, modified curl-ups ,low back extension, and lateral pull-down. Resistance was increased by 10% when participants completed more than 12 repetitions

Statistical Analysis.

The mean values of data obtained for both groups before and after the study period were compared using paired "t" test. Independent "t" test was used for the comparison between the two groups , value of $p \leq 0.05$ was considered statistically significant . All statistical measures were performed through the statistical package for social studies (SPSS) version 19 for windows.

IV. Results

Figure 1 shows the flow diagram of patient recruitment and randomization. Of in70 women who manifested interest in participating in the study, 30 were excluded based on the adopted criteria. In total, 40 cancer survivors women performed all baseline assessments, and 37 of them completed the interventions. The characteristics of the participants are presented in Table (1). There were no differences in age, weight, height, body mass index, stage of cancer, type of chemotherapy regimen and duration of treatment with chemotherapy and radiotherapy($p > 0.05$).

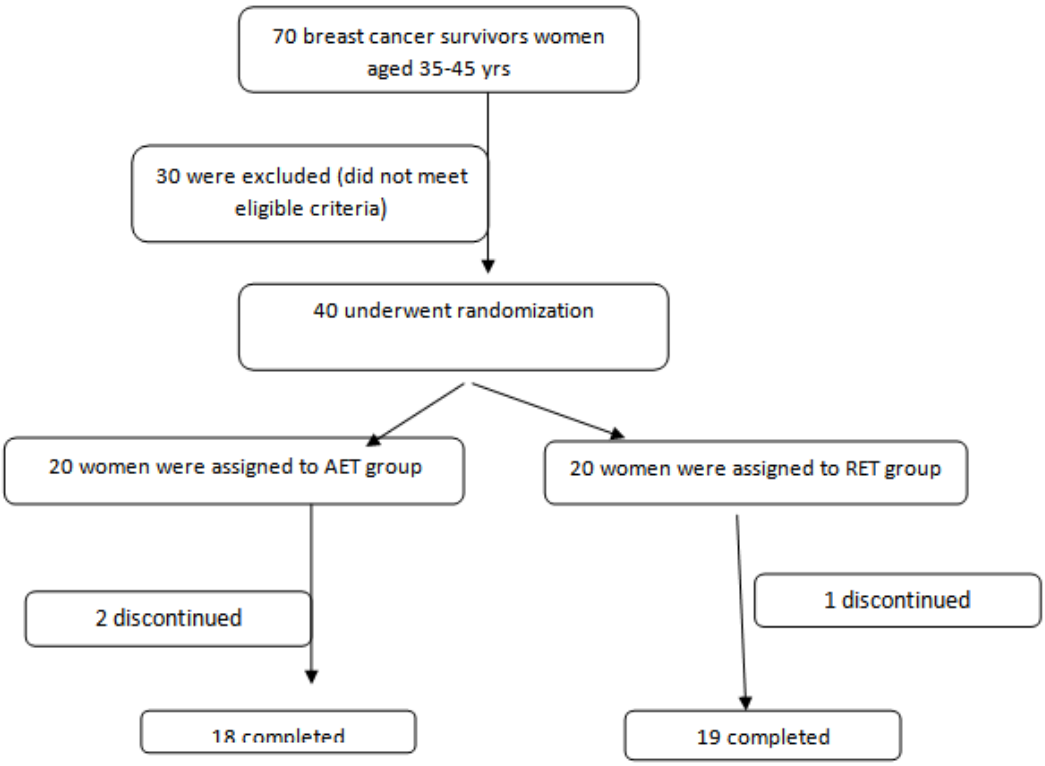

Fig 1: flow diagram of patient recruitment and randomization

Table (1) baseline characteristics of both groups:

Variables	AET group (n=18)	RET group: (n=19)	p-value
Age(yrs)	39±45	40±3.6	0.07
Weight(kg)	83.27 ± 5.6	81±3.9	0.09
BMI(kg/m^2)	31.4±2.9	30±3.8	0.11
Cancer stage :n(%) Stage I Stage II	 14(77.7) 4 (22.3)	 15(78.9) 4 (21.1)	 0.16 0.14
Chemotherapy regimen: n(%) FEC-60 FEC-100 FEC-60 + Taxotere	 7(38.8) 8(44.5) 3(16.7)	 7(36.8) 9(47.3) 3(15.8)	 0.41 0.63 0.38
Radiotherapy: n(%)	16(88.8)	179(89.4)	0.71
Intervention duration (weeks)	18.5±4.8	16.4±5.6	0.82

Values are presented as mean ± standard deviation; FEC-60: chemotherapy regimen of fluorouracil, epirubicin and cyclophosphamide administered in 60mg/m^2 dosage; FEC-100: chemotherapy regimen of fluorouracil, epirubicin and cyclophosphamide administered in 100mg/m^2 dosage ; p- Value > 0.05: There were no differences between groups in their general characteristics

Table (2): Mean and standard deviations for study variables at baseline and after 12 weeks in both groups

Variable	AET group(n=20)	RET group (n=20)	p-value
6-MinuteWalk Test(m) Pre Post p-value	 659 ± 54.6 745 ± 67.8 0.013*	 643± 56.5 711± 45.4 0.063*	 .083 .001*
VO2max (ml/min/kg) Pre Post p-value	 24.75 ± 4.95 30.65± 2.34 0.001*	 25.35 ± 3.97 29.35± 1.32 0.003*	 0.123 0.023*
MFI-20 Pre Post p-value	 74.1 ± 3.87 58.45± 4.32 0.0001*	 75.69 ± 3.89 65.45± 2.32 0.001*	 0.63 0.003*

Values are presented as mean ± standard deviation;VO2 max: maximum oxygen consumption; MFI-20 : Multidimensional Fatigue Inventory; ***** significant ($p \leq 0.05$)

V. Discussion

The present study compared the effect of aerobic versus resistance training intervention on cancer-related fatigue, cardio respiratory fitness, and physical activity levels following adjuvant breast cancer chemotherapy and radiotherapy. The results provide information on exercise dose (frequency, intensity, duration, and mode) sufficient to relieve treatment-related symptoms and restore physical capacity in breast cancer patients.

It has been found that fatigue is a long-lasting side effect of cancer treatment.(18) The results of current study demonstrated a positive therapeutic effect of both aerobic and resistance training. However the changes were better and in favor of aerobic training . Distance walked during 6-MinuteWalk Test and VO2 max significantly increase in both groups when comparing pre and post test results. These improvements were in favor of aerobic training. The MFI20 showed statistically significant decrease in AET and RET groups . However results were in favor of AET group.

Preserving aerobic fitness in breast cancer patients receiving chemotherapy may be beneficial. In our trial, improved aerobic fitness was associated with improved QOL, fatigue, depression, and anxiety, suggesting that greater increases in aerobic fitness may have resulted in better patient-rated outcomes. Aerobic fitness is also an established predictor of disease and mortality. (19)

Similar to those results were the results of Tsui-Yun Yang et al.,(20) who evaluated the efficacy of an aerobic exercise program on fatigue for Taiwanese breast cancer women under radiotherapy. The fatigue severity decreased significantly over time for women in the intervention group but increased over time for women in the control group suggesting that prescribed aerobic exercise with mild to moderate intensity can decrease fatigue levels during radiotherapy for women with breast cancer.

Ellen van Weert et al.(21) performed a 15 weeks exercise rehabilitation program which was effective in reducing fatigue measured using MFI, and improving physical performance and exercise capacity measured using symptom-limited bicycle ergometry.

Similar to this study were the results by Courneya KS et al.(22) who approved the beneficial effects of aerobic exercises following treatment of breast cancer survivors who were given a moderate intensity cycle ergometer intervention, three times per week for 15 weeks. Sessions were 15 minutes in duration during weeks 1 through 3, and progressed to 35 minutes by weeks 13 through 15. Participants in the exercise group showed significant improvements in cardiopulmonary function and quality of living.

On their study to compare AET and RET in breast cancer survivors Kerry et al. (23) concluded that cancer care professionals should consider recommending either AET or RET to breast cancer patients receiving chemotherapy. A combined intervention may be optimal, but research is needed to confirm this assumption, especially given the challenges of exercise adherence in this clinical setting.

combined aerobic and resistance training leads to a significant reduction in fatigue in cancer survivors. (24) Only one study examined the effects of resistance training alone, although this was also beneficial.(25) The effects of resistance exercise have not been addressed by the American Cancer Society(26) but have been examined recently in people undergoing cancer treatment. (27) However more evidence about resistance training alone would be helpful in advising people with cancer who are undergoing cancer therapy whether this type of training is helpful in isolation. (24) To understand the possible mechanisms, more information is required regarding the effects of initial chemotherapy and radiation therapy on muscle satellite (progenitor) cells that are activated to proliferate in response to resistance exercise.(28)

Exercise intensity, for diagnostic or exercise prescription purposes are expressed in terms of oxygen consumption (VO2), heart rate (HR), and/or ratings of perceived exertion. (29) Maximal oxygen consumption (VO2max) is generally accepted as the criterion measure of cardio-respiratory capacity.(30) One of the limitations of the study is the lack of direct measurement of Vo2 max through cardiopulmonary exercise testing. There were budgetary constraints and that the measurement of VO2max is generally restricted to sophisticated research settings due to the specialized equipment required. In this study, six minute walk test was used to indicate Vo2 max and heart rate was used as valid indicators of exercise intensity.

The Six-Minute Walk Test (6 MWT) is an inexpensive, relatively quick, safe and a well-tolerated method of assessing the functional exercise capacity of patients with moderate-to-severe heart or lung disease. Its use has found popularity in following the natural history of various diseases, for timing of procedures such as heart or lung transplantation and for measuring the response to medical interventions.10 There has been a substantial body of literature published looking at the relationship between 6 MWT and peak VO2 in individuals.(31,32) all training sessions in our study were directly supervised by an investigator, a procedure that has been shown to be important in causing maximal gains during strength training compared to unsupervised programs. (7)

The findings of this study should be interpreted with caution due to some limitations. The employed research design does not make it possible to control for changes in the effects of cancer therapy on dependent variables over time. Although elevated levels of cancer-related fatigue and reduced physical fitness and activity levels should be expected also six months after chemotherapy. (33)one cannot rule out that diminishing side effects of chemotherapy could explain the results it should be taken in consideration that the fatigue experience might have been reduced due to passing of time since chemotherapy.

VI. Conclusions

The findings suggest that aerobic or resistive exercise programs are enough to sufficiently relieve cancer-related fatigue and restore physical fitness and activity levels in breast cancer survivors, However aerobic program is much better. The results of this study can be used to guide cancer care professionals to inform and motivate women with breast cancer to initiate and maintain exercises as a health behavior following chemotherapy according to guidelines provided for breast cancer populations.

Conflict of Interests

The authors declare that there is no conflict of interests
regarding the publication of this paper.

Acknowledgement

The author would thank all participants

AUTHOR CONTRIBUTIONS

All authors contributed equally in all parts of this study

References

[1]. Stone P, Richardson A, Ream E, Smith A, Kerr D, Kearney N, 2000: Cancer related fatigue, inevitable, unimportant and untreatable? Results of a multi-centre patient survey. Cancer Fatigue Forum Ann Oncol.;11:971–975

[2]. National Comprehensive Cancer Network, 2013. Clinical Practice Guidelines in Oncology .http://www.nccn.org/professionals/physician_gls/pdf/fatigue.

[3]. Aulin J, Hugerth M, Wallenberg S, Wagenius G. Fatigue in cancer patients treated with cytotoxic drugs. J Oncol Pharm Pract. 2006;12:155–164.

[4]. Brown JC, Huedo-Medina TB, Pescatello LS, Pescatello SM, Ferrer RA, Johnson BT, 2011. Efficacy of exercise interventions in modulating cancer-related fatigue among adult cancer survivors: a meta-analysis. Cancer Epidemiol Biomarkers Prev.;20:123–133

[5]. Cramp F, Byron J, 2012. Exercise for the management of cancer-related fatigue in adults. Cochrane Datab Sys Rev.;11:CD006145

[6]. Hayes S C, Davies P S, Parker T W, Bashford J, Green A, 2004. Role of a mixed type, moderate intensity exercise program after peripheral blood stem cell transplantation. Br J Sports Med.; 38 304-309

[7]. Herrero F. , San Juan A. F. ,. Fleck S. J , J. Balmer , M. Pérez , S. Cañete , C. P. Earnest5 , C. Foster , A. Lucía, 2006: Combined Aerobic and Resistance Training in Breast Cancer Survivors: A Randomized, Controlled Pilot Trial. Int J Sports Med. ; 27(7): 573-580

[8]. Lin KY, Shun SC, Lai YH, Liang JT, Tsauo JY, 2014. Comparison of the effects of a supervised exercise program and usual care in patients with colorectal cancer undergoing chemotherapy. Cancer Nurs. Mar-Apr;37(2):E21-9

[9]. Schneider CM, Hsieh CC, Sprod LK, Carter SD, Hayward R. 2007: Effects of supervised exercise training on cardiopulmonary function and fatigue in breast cancer survivors during and after treatment. Cancer.;110:918–925.

[10]. Crapo m R. O.,. Casaburi R,. Coates A. L et al., 2002 "ATS statement: guidelines for the six-minute walk test," *American Journal of Respiratory and Critical Care Medicine*, vol. 166, no. 1, pp. 111– 117,

[11]. Walter Villalobos, ; Clara Lopez de Mesa; Luis F. Giraldo,; Javier J. Zulueta, 2007 :RELATION BETWEEN THE 6-MINUTE WALK TEST AND THE MAXIMUM OXYGEN CONSUMPTION*: Chest.*;132(4_MeetingAbstracts)

[12]. Enright P. L., 2003 "The six-minute walk test," *Respiratory Care*, vol. 48, no. 8, pp. 783–785,.

[13]. Lin J-MS., Brimmer DJ., Maloney EM., Nyarko E., BeLue R., Reeves WC. (2009): Further validation of the Multidimensional Fatigue Inventory in a US adult population sample. Population Health Metrics.7:18. Doi: 10.1186/1478-7954-7-18.

[14]. Smets, E. M. A., Garssen, B., Bonke, B., & De Haes, J. C. J. M. (1995). The multidimensional fatigue inventory (MFI)psychometric qualities of an instrument to assess fatigue. *Journal of Psychosomatic Research, 39* (5), 315–325

[15]. Sharon A. Plowman; Denise L. Smith (1 June 2007): Exercise Physiology for Health, Fitness, and Performance. Lippincott Williams & Wilkins. p. 61. ISBN 978-0-7817-8406-1. Retrieved 13 October 2011

[16]. Borg G. A. V., 1982 "Psychophysical bases of perceived exertion," *Medicine and Science in Sports and Exercise*, vol. 14, no. 5, pp. 377–381,.

[17]. Kraemer WJ, Adams K, Cafarelli E, et al., 2002: American College of Sports Medicine position stand: Progression models in resistance training for healthy adults. Med Sci Sports Exerc 34:364-380,

[18]. Harrington C. B.,.Hansen J. A, Moskowitz M., Todd B. L., and Feuerstein M., 2010 "It's not over when it's over: long-termsymptoms in cancer survivors-a systematic review," *International Journal of Psychiatry in Medicine*, vol. 40, no. 2, pp. 163–181,.

[19]. Myers J, Prakash M, Froelicher V, et al., 2002: Exercise capacity and mortality among men referred for exercise testing. N Engl J Med 346:793-801,

[20]. Tsui-Yun Yang, Mei-Ling Chen and Chia-Chun Li (2015): Effects of an aerobic exercise program on fatigue for patients with breast cancer undergoing radiotherapy, Journal of Clinical Nursing ,24, 202–211

[21]. Ellen van Weert, Josette Hoekstra-Weebers, Renée Otter (2006): Cancer-Related Fatigue: Predictors and Effects of Rehabilitation, The Oncologist;11:184–196.

[22]. Courneya KS, Mackey JR, Bell GJ, Jones LW, Field CJ, Fairey AS. (2003): Randomized controlled trial of exercise training in postmenopausal breast cancer survivors: Cardiopulmonary and quality of life outcomes. J Clin Oncol ;/21/: 1660 8.

[23]. *Kerry S. Courneya, Roanne J. Segal, John R. Mackey, Karen Gelmon, Robert D. Reid* et al , 2007: Effects of Aerobic and Resistance Exercise in Breast Cancer Patients Receiving Adjuvant Chemotherapy: A Multicenter Randomized Controlled Trial JOURNAL OF CLINICAL ONCOLOGY 25 NUMBER 28; 4396-4404

[24]. Jose´ F Meneses-Echa´vez a, Emilio Gonza´ lez-Jime´nez b, Robinson Ramı´rez-Ve´ lez, 2015 :Supervised exercise reduces cancer-related fatigue: a systematic review Journal of Physiotherapy 61: 3–9

[25]. Segal RJ, Reid RD, Courneya KS, Sigal RJ, Kenny GP, Prud'Homme DG, et al, 2009: Randomized controlled trial of resistance or aerobic exercise in men receiving radiation therapy for prostate cancer. J Clin Oncol.;27:344–351

[26]. American Cancer Society. Cancer facts & figures. Atlanta 2012: American Cancer Society

[27]. Clarkson PM, Kaufman SA, 2010. Should resistance exercise be recommended during breast cancer treatment? Medical Hypotheses.;75:192–195.

[28]. Strasser B, Steindorf K, Wiskemann J, Ulrich CM, 2013. Impact of resistance training in cancer survivors: a meta-analysis. Med Sci Sports Exerc.;45:2080–2090

[29]. Borg G,1970: Perceived exertion as an indicator of somatic stress. *Scand J Rehabil Med* 2:92-98.

[30]. American College of Sports Medicine,1991: *Guidelines for exercise testing and prescription* 4th edition. Lea & Febiger: Philadelphia;:93-109

[31]. Cahalin L, Pappagianopoulos P, Prevost S, Wain J, Ginns L, 1995: The relationship of the 6-min walk test to maximal oxygen consumption in transplant candidates with end-stage lung disease**.** *Chest*, 108(2):452-9.

[32]. Cahalin L, Mathier MA, Semigran MJ, Dec GW, DiSalvo TG, 1996: The six-minute walk test predicts peak oxygen uptake and survival in patients with advanced heart failure**.** *Chest*, 110(2):325-32.

[33]. Andrykowski M. A., Donovan K. A., Laronga C., and. Jacobsen P. B, 2010 "Prevalence, predictors, and characteristics of off treatment fatigue in breast cancer survivors," *Cancer*, vol. 116, no. 24, pp. 5740–5748,.